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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PRELIMINARY ANNOUNCEMENT OF THE MINNEAPOLIS MEETING

Edited by Dr. HENRY B. WARD
PERMANENT SECRETARY

THE summer meeting of the association will be held this year in Minneapolis, Minnesota, from Monday, June 24, to Saturday, June 29, inclusive. This will be the ninety-sixth meeting of the association and the third to be held in that city. The thirty-second meeting in August, 1883, and the sixty-second in December, 1910, were those previously held in Minneapolis. It will be interesting to recall briefly something of those early meetings.

On both occasions the University of Minnesota acted as host for the sessions and both are recorded as well attended and well provided with all those conditions needed to insure a successful scientific congress. This year the university again welcomes the association and this time to its new campus, widely recognized as one of the most beautiful, capacious and well arranged among the campuses of the great state universities. The evening general sessions and most of the sectional and society meetings will be held in lecture rooms on the Minneapolis campus, but use will also be made of facilities on the University Farm campus in St. Paul.

The meeting in August, 1883, was an early venture into the Northwest, being the third held beyond the Mississippi River. Out of a total membership of 2,033 the registration, visitors included, reached 328. In all 168 papers were listed in the program and the proceedings of the meeting. These, printed in full by the association, made up an impressive volume of 508 pages, one of the largest in the entire series. At

the meeting in December, 1910, the registered total attendance was 663 and the membership roll included 8,012 names. About 530 papers were programmed for various sessions. The practice of issuing a volume that contained all the papers presented at the meeting had been abandoned some years before 1910. The eleven sections then existing met in conjunction with related affiliated societies and legislation was adopted approving and perfecting this general plan, which has since been followed whenever such affiliated societies are in session at the meeting.

Again this year, as has proved advantageous previously, emphasis is laid in programs of sections and societies on symposia and joint sessions. Even greater provision is made for field trips near Minneapolis and some are planned to areas of especial interest in more distant parts of the state. The occasion is certain to afford varied opportunities for scientific contacts and studies.

Local Committee, Officers of Sections and Cooperating Organizations

The general chairman of the local committee is Dwight Elmer Minnich, professor and chairman of the department of zoology at the University of Minnesota; the general secretary is Donald Gildersleeve Paterson, professor of psychology, University of Minnesota. About forty members of the association and cooperating organizations are engaged as members of committees and subcommittees arranging programs and entertainment for the meeting. The following sections with the officers indicated have arranged the particular programs and the facilities for the meetings of the sections and the associated societies meeting in Minneapolis at this time.

In Mathematics Professor Dunham Jackson is acting secretary and Professor William L. Hart local representative. In Physics the acting secretary is Professor John T. Tate, and Dr. Henry A. Erikson is local representative. The American Meteorological Society is meeting with the section. The American Physical Society is meeting in Minneapolis on June 21 and 22, just prior to the opening of the association meeting. In Chemistry Professor Samuel C. Lind is acting secretary and local representative. In Astronomy Professor Willem J. Luyten is acting secretary and local representative. The Society for Research on Meteorites will meet in conjunction with the section. In Geology and Geography the acting secretary and local representative is Professor Frank F. Grout.

In the Zoological Sciences Professor William A. Riley is acting secretary and local representative. The Parasitologists will meet with the Zoologists. In the Botanical Sciences the acting secretary is Dr. Loren C. Petry and the local representative Professor C. O. Rosendahl. The Botanical Society of America, the American Society of Plant Physiologists and the American Phytopathological Society are meeting with the Botanists. The Ecological Society of America will meet with the Zoologists and Botanists. In Anthropology Professor W. M. Krogman is secretary and the local representative is Professor Albert E. Jenks. In Psychology Professor John E. Anderson is acting secretary and local representative. In Social and Economic Sciences the acting secretary is Professor F. Stuart Chapin, and Roland S. Vaile is local representative. The American Sociological Society joins with the section.

In the Medical Sciences the secretary is Dr. Vincent du Vigneaud and the local representative is Dr. W. A. O'Brien. The American Pharmaceutical Association will meet jointly with the section. A local branch of the Society of American Bacteriologists is considering meeting in conjunction with the Section on Medical Sciences.

In Agriculture Professor H. K. Hayes is acting secretary and Dr. Walter C. Coffey is local representative. The American Society of Agronomy (Corn Belt Section), the Dairy Science Association, the Great Plains Section of the American Society for Horticultural Science, the Genetics Society of America and the Association of Official Seed Analysts are meeting with the Agriculturists. In Education the secretary is Professor William S. Gray, and Professor Harold Benjamin is local representative.

Joint Meeting with Minnesota State Medical Association

An unusual feature of the Minneapolis meeting is found in the arrangement for joint sessions and an exchange of privileges with the Minnesota State Medical Association, which is to hold its eighty-second annual meeting in Minneapolis from Monday, June 24, to Wednesday, June 26. The American Association has arranged with the Minnesota society to hold a joint general session on Monday evening, at which the speaker will be Dr. W. P. Murphy of Boston, who comes on the invitation of the Minnesota State Medical Association. The privileges of the evening general sessions and other meetings of the American Association and its sections have been extended to all members and visitors registered for the Minnesota State Medical Association. In return the members of the American Association have been invited to attend any of the lectures or scientific demonstrations and exhibits as guests of the medical society. The A. A. A. S. badge will serve as sufficient identification for admission.

Joint sessions of the Section on Medical Sciences and the medical society have been arranged on Monday and Tuesday mornings. On Monday morning Dr.

Hansen, of Faribault, Minnesota, will give a paper on the "Biological Effect of Thymus and Pineal Extracts," and Dr. Cutler, of Chicago, will discuss "The Recent Advances in the Treatment of Cancer." In the afternoon three very interesting papers will be given on clinical allergy, hyperthyroidism and the pathogenesis of gall bladder disease. On Tuesday morning a joint session will be held with the Section on Medical Sciences for a symposium on diseases of the blood. In the afternoon of the same day Dr. Brown, of Boston, will discuss the "Inception and Development of Fluoroscopy," Dr. Sevringhaus, of Madison, will present a paper on "Endocrine Therapy," and Dr. Plass, of Iowa City, will discuss "Simplification of Obstetrical Care." At ten o'clock and at two on both Monday and Tuesday, scientific demonstrations and exhibits will be shown by the Minnesota State Medical Association. Many of these will be of much interest to the members of the American Association. Various exhibits concerning cancer, prevention of deafness, mental health, physical therapy, tuberculosis and the like will be shown. An interesting series of exhibits will also be presented concerning the endocrines, including a very extensive one concerning diabetes mellitus.

Headquarters and Registration

General headquarters for the meeting and the main registration office will be in the lobby of the Northrop Auditorium on the University of Minnesota campus, in Minneapolis. The building is centrally located with reference to all other buildings on the campus and will be a convenient social gathering place for members attending the meeting. The office of the permanent secretary will also be located in this building. Officers of the association will be quartered in the Hotel Nicollet, which will be hotel headquarters. Mail, telegrams, etc., may, if desired, be addressed to Headquarters, A. A. A. S., Northrop Auditorium, University of Minnesota, Minneapolis, Minn.

Registration will be open, upon payment of a fee of $1.00, to all persons who are interested in the advance of science or education. Each registrant receives a copy of the program, an identification card and a badge. Registration will be necessary for attendance upon the general reception, participation in excursions and other events.

Transportation

Reduced railway rates on the receipt certificate plan have been granted by almost all railroads in the United States and Canada. The only exceptions are a few short lines in the Southwestern Passenger Association.

Persons attending the meeting should purchase a first-class, one-way ticket to Minneapolis, securing a receipt certificate reading "For the American Association for the Advancement of Science and Associated Societies, and the Minnesota State Medical Association." The certificate must be left at the registration desk for endorsement and validation, to be called for later in the same place. Each person presenting an endorsed and validated certificate may purchase a return ticket for one third of the regular fare, on the same route as used in going to Minneapolis. Tickets to Minneapolis from many points may be purchased between June 19 and 25, although from far western

Hotel Accommodations in Minneapolis

Name of Hotel	*Address*	*Minimum rates*			
		Without bath		*With bath*	
		Single	*Double*	*Single*	*Double*
Nicollet (General Headquarters)	Washington and Nicollet	$2.00	$3.50	$2.50	$4.00
Curtiss	10th and 3rd to 4th Avenues			2.00	3.00
The Leamington	10th and 3rd Avenue, South			2.00	3.00
Radisson	45 S. 7th Street	2.00	3.50	3.00	4.50
Sheridan	1112 Marquette Avenue	1.25	1.75	2.00	2.50
West	Hennepin at 5th Street	1.25	2.00	1.75	2.50
Andrews	Hennepin at 4th Street	1.50	2.50	2.25	3.25
Dyckman	27 South 6th Street			2.00	3.00
Vendome	17 S. Fourth Street	1.00	1.50	1.50	2.50
Maryland	1346 LaSalle Avenue			1.50	2.50
Francis Drake	10th and 5th Avenue, South			2.00	2.50
Hastings	12th and Hawthorne Avenue			1.50	2.25
Buckingham	1500 LaSalle Avenue			2.00	2.75
Field	510 S. 8th Street	1.25	2.00	2.00	2.50
Oak Grove	230 Oak Grove			2.00	3.00

points they may be purchased as early as June 17. Return tickets must be purchased by July 3 and in most instances these tickets will be good for thirty days, including date of sale of going ticket, as shown by selling agent's stamp on certificate.

The privilege of reduced rates is limited to bona-fide members of the association and its associated societies and the Minnesota State Medical Association and immediate members of their families.

Persons residing outside the regions of reduced rates should each purchase a round-trip ticket to the nearest station issuing through tickets to Minneapolis and situated within the region of reduced rates. On arrival at that station a one-way ticket to Minneapolis and a certificate, as directed in the preceding paragraph, should be secured.

In view of the fact that the railroads are likely to announce special summer excursions, it is advisable to consult the local ticket agent. It is advisable also to consult the agent regarding the various periods when going tickets may be purchased on the certificate plan.

The Andrews, Dyckman, Hastings, Nicollet, Radisson, West and Vendome hotels are within one block or less of street cars, which run direct to the university; the Buckingham, Curtis, Field, Francis Drake, Leamington, Maryland, Oak Grove and Sheridan are three blocks or further from the direct car lines but are close to other car lines which have transfer connections with these lines. The buses to the university either pass the door or within two blocks of the Andrews, Dyckman, Nicollet, Radisson, Vendome and West hotels. The street car running time directly to the university is 12 minutes and the bus 12 minutes.

General Sessions

The evening general sessions will all be held in the Northrop Auditorium on the Minneapolis campus of the university. The opening session on Monday evening will be a joint session with the Minnesota State Medical Association. Dr. Karl T. Compton, president of the American Association, and Dr. W. A. Coventry, president of the Minnesota State Medical Association, will preside. The address will be given by Dr. W. P. Murphy of Boston, on the subject "Diseases of the Blood." At the general session on Tuesday evening, which will be the Maiben lecture, Dr. Richard P. Strong, of the Harvard University Medical School, will speak on the topic "The Importance of Ecology in Tropical Disease." This will be followed by an informal reception given by President L. D. Coffman, of the University of Minnesota, and Mrs. Coffman for the visiting scientists. Dr. Isaiah Bowman, director of the American Geographical Society, will address the general session on Wednesday evening, on the subject "The Land of Your Possession." At the Thursday evening general session Dr. Wm. F. G. Swann, director of the Bartol Research Foundation, will speak on "The Nature of Cosmic Rays." The Friday evening address will be given by Dr. Philip Fox, director of the Adler Planetarium and Astronomical Museum, on the subject "The Scale of the Universe."

A symposium on "Conservation," organized by the local committee for the Minneapolis meeting, deserves especial mention. This will be held on Thursday morning in the Northrop Auditorium. The program will cover some of the broad aspects of the problem, and the speakers will include men of national reputation in this field. President L. D. Coffman, of the University of Minnesota, will preside and make the introductory address. He will also introduce the speakers. This major event of the meeting has been provided through generous cooperation from the university and is aimed to introduce to students of the University Summer School then in session the views of distinguished scientists on this important problem.

Social Events

On Tuesday evening following the Maiben lecture President L. D. Coffman, of the University of Minnesota, and Mrs. Coffman will give an informal reception to visiting scientists.

The Minnesota State Medical Association will hold its annual dinner on Tuesday evening.

A joint luncheon is planned for Tuesday by the Sections on Mathematics, Physics and Astronomy.

Phi Lambda Upsilon will hold its luncheon on Wednesday at the Minnesota Union.

A dinner under the auspices of Phi Delta Kappa and Pi Lambda Theta, in which the Section on Psychology and the Section on Education will join, is scheduled for Thursday evening.

A number of other informal social gatherings for smaller groups and individual societies are being planned.

Exhibits and Demonstrations

A number of special exhibits are being planned by various departments of the university. The Department of Anthropology will have a number of such exhibits, including the Browns Valley Man and the Minnesota Man. An exhibit of early books and manuscripts dealing with natural science will be on display in the lobby of the University Library. The Museum of Natural History with its magnificent habitat groups, the Geological Museum, the Herbarium and the entomological collection at the University Farm will hold open house throughout the week. Various other departments are planning additional exhibits. The exhibits of the Minnesota State Medical Association are described in connection with the program of the Section on Medical Sciences.

THE TWIN CITIES REGION

(*By Thomas E. Steward, University News Service*)

The region of the Twin Cities, including Minneapolis and St. Paul, offers many attractions to the visitor who would combine sightseeing with the scientific activities of an association meeting. Both cities lie above the Mississippi River, though on opposite banks, St. Paul being downstream from Minneapolis. On each bank of the river are winding drives that offer the motorist attractive views.

In point of actual beauty few cities have more to offer than has Minneapolis. In preglacial times the Mississippi flowed through what is now the city, and when the ancient river was diverted by debris the old channel became a chain of lakes, around which the better residence sections have sprung up. Parked drives wind past these lakes and follow Minnehaha Creek to the ledge where that famous stream drops to the level of the Mississippi in Minnehaha Fall, so well known from Longfellow's poem. During the drier parts of the year the stream and falls are, unfortunately, quite dry. Especially beautiful are Lake Harriet and Lake of the Isles, but the others, Calhoun, Cedar and Nokomis, will well repay a visit.

Fort Snelling stands at the point where the Minnesota River flows into the Mississippi. Dating back to about 1820, it offers many attractive glimpses of the distant past at a Northwest outpost, together with the evidences of more recent developments.

Eighteen miles west of Minneapolis lies Lake Minnetonka, once famous as a summer outing place for people from the South and now the site of many fine homes. A thirty-mile drive around this lake will carry one past many scenes of worthwhile beauty.

In Summit Avenue St. Paul has one of the outstanding residence streets of the country, and those who go from one city to the other would do well to follow this tree-lined route, which is both direct and most attractive.

Persons interested in the industrial life of the region will find in Minneapolis many plants devoted to the production of cereal foods, including flour, feed, breakfast foods, macaroni, and the like, also extensive linseed crushing establishments and elevators for the storing of grains and linseed. There also are important plants devoted to the fabrication of ornamental products of iron, brass and bronze. Nearby, at South St. Paul, are extensive packing plants. Some of the largest dairy manufacturing plants in the country are to be found in St. Paul and Minneapolis, and St. Paul is a considerable center of metal fabrication and of the railroad shop and maintenance industry.

Among cultural activities there may be listed in Minneapolis the Minneapolis Institute of Arts, the Walker Gallery, the Minneapolis Symphony Orchestra, the University of Minnesota and, a few miles from the main campus, University Farm, in St. Paul, site of the College of Agriculture, Forest and Home Economics and of the Agricultural Experiment Station.

Among the independent or church colleges in the cities are Augsburg Seminary, College of St. Thomas, College of St. Catherine, Macalester College and Hamline University. Two junior colleges, Bethel Institute and Concordia College, are located in St. Paul.

The background of the business and industrial life of the Twin Cities region is primarily agricultural and arises from the production, shipping and manufacture of dairy, cereal, linseed, corn and animal products. For those with a special interest in any or all of these, exceptional opportunities for observation will be at hand.

Less than twenty miles east of the Twin Cities one comes to the St. Croix River, which in early postglacial times drained Lake Superior into the Mississippi, while ten miles south of Minneapolis is the Minnesota River, known to geologists as the River Warren. As such it drained Lake Agassiz, when that great glacial body of water covered much of northwestern Minnesota and eastern North Dakota.

Adjacent to Minneapolis and St. Paul is an area of varied agriculture. About forty miles southwest lies Northfield, site of the two important independent colleges, St. Olaf and Carleton.

SCENIC ATTRACTIONS AND VACATION OPPORTUNITIES

Minnesota has vacation opportunities superior to those of a majority of the states in which an association meeting is held. Called the state of "Ten Thousand Lakes," it is at least supplied with an unusual number of attractive inland bodies of water, left in particularly large numbers over the northern two thirds of the state by the receding glaciers.

Among the larger of the Minnesota lakes are Mille Lacs, 100 miles north of Minneapolis, Leach Lake, about 180 miles northwest of Minneapolis, Cass Lake, just north of Leach Lake, and Lake Winnibigoshish, on the northeast point of a triangle formed with Cass and Leach Lakes. Fifty miles northwest of Winnibigoshish lies Red Lake, most remote and largest of the Minnesota lakes, not especially picturesque, but interesting because of the large Indian settlements nearby. There also are reservations near the other three big lakes, excepting Winnibigoshish.

Scattered throughout the rest of the state, particularly north of Minneapolis and St. Paul, lie literally a myriad of other lakes of different sizes and attractions. Principal recognized centers from which these can be reached are Brainerd, Alexandria, Park Rapids, Detroit Lakes, Grand Rapids, Ely and Bemidji, and the tourist who finds himself in any of these towns will

have no difficulty in locating a number of splendid outing spots.

Those who wish a rugged outing of the "back yonder" variety had best visit what are called the "border lakes." These are remote lakes of extreme beauty lying along the Canadian boundary. Access to them is gained at the western end through International Falls and Crane Lake; half way across through Ely, via Basswood Lake; and at the eastern end, by way of the Gunflint trail, which runs back to the Canadian border lakes from the town of Grand Marias.

Combined with the eastern border lakes are the attractions of Minnesota's really fine north shore drive, along the northern shore of Lake Superior. From Duluth, Minnesota's big lake port at the apex of Lake Superior, this drive runs northeast to the Canadian border, and across it to Port Arthur, Ontario, and the famous Nipigon River.

The highest and most rugged country in Minnesota lies just inland from the north shore drive and the views of the great freshwater sea, Lake Superior, are superb over most of the 180 miles between Duluth and Pigeon River at the border. Near the latter point one may follow on foot the route of the old Grand Portage, by which French and later British traders found their way inland from Superior to the Pigeon River and the border lakes in their quest for furs.

Just over the Canadian border lies the Quetico area of Canada, one of the finest game areas and canoe-trail districts in the world, and similar in these respects to the Minnesota region that it borders. No shooting will be legal in June, but splendid fishing, camping and canoeing will be available.

The St. Croix River, already mentioned, will provide many scenic attractions to those who wish to visit it, while northern Wisconsin is in many respects similar to northern Minnesota, although it ends at the south shore of Lake Superior.

Minnesota in general is made up of a rugged, unglaciated area in the southeast, a rich farming country in the south, a prairie farming region in the southwest and central west, the famous Red River Valley in the northwest, and at the north and northeast cutover forest areas that merge imperceptibly into wilderness as one comes nearer to the Canadian boundary.

In such a state those seeking outdoor recreation may take their pick, although, as in any other place, careful advance selection of a route will mean greatly increased satisfaction over the outing.

EXCURSIONS

The following preliminary summary of excursions which are contemplated by various sections and societies is compiled from the reports sent in and is subject to modification. Complete details as to places, routes, starting times, expenses and other important features will appear in the final program to be issued on registration in Minneapolis. Further information may be secured at the special desk in the registration room at the Northrop Auditorium.

General trips will be arranged to visit (1) Minneapolis parks and parkways and (2) Minneapolis mills and milling districts.

The Section on Medical Sciences will meet on Thursday in Rochester at the Mayo Foundation. The morning program there will be devoted to reading papers. In the afternoon the general offices of the Mayo Foundation, the Hygienic Museum and the Experimental Institute will be visited. Members of the section and others interested, especially those in biological sciences, are invited to participate.

Special trips are being planned as follows:

Tuesday afternoon. A field trip to the Minnesota River Valley or the St. Croix River Valley has been arranged by the Section on Botanical Sciences, the Botanical Society of America and other botanical organizations, in which the Ecologists will join. The afternoon will also be used by the Great Plains Section of the American Society for Horticultural Science for an inspection of horticultural plots at the University Farm, and by the Section on Agriculture and cooperating societies for a field trip to Moscrip's Farm, Lake Elmo, to observe studies of pasture management.

Wednesday (all day). The Section on Botanical Sciences, the Botanical Society of America and other botanical organizations will go on a trip to the Bunker Prairie Region. The Ecologists will either join the Botanists or will go with the Zoologists for an afternoon trip to sand dunes in the vicinity of the Twin Cities. The same afternoon the Plant Physiologists will visit the University Fruit Breeding Farm. The Section on Agriculture and cooperating societies will devote the day to inspecting demonstrations of agricultural research by the University of Minnesota divisions of agronomy and plant genetics and plant pathology and botany at the University Farm. The Great Plains Section of the American Society for Horticultural Science has arranged a field trip for the morning through Como Park, mushroom caves and vegetable-growing regions near South St. Paul, and for the afternoon to Faribault to visit nurseries, seed houses, etc., as well as parks and greenhouses in the Twin Cities.

Thursday (all day). The American Society of Agronomy will go to Lake Mille Lacs to observe the High-lime Peat Experimental Field at Coon Creek and the Low-lime Peat Experimental Field at Page. The American Phytopathological Society has arranged a morning trip to local market garden regions and an afternoon trip to the fruit breeding farm. The Amer-

ican Society for Horticultural Science will visit on Thursday morning the Coon Creek Experimental Farm, vegetable growing areas near Anoka, early potato regions near Osseo and melon districts near Brooklyn Center, and in the afternoon the University of Minnesota Fruit Breeding Farm near Zumbra Heights.

Thursday and Friday. A two-day trip to Itasca State Park, the Cloquet Forest Experiment Station and the north shore of Lake Superior has been planned by the Section on Botanical Sciences, the Botanical Society of America and other botanical organizations. In this the Plant Physiologists and Ecologists will join.

Friday (all day). The American Society for Horticultural Science has arranged a trip to the Cloquet Forest Experiment Station, Northeast Experiment Station near Duluth, Iron Range, and North Central Experiment Station at Grand Rapids.

Additional field excursions for which the dates are not fixed include the following: One or two half-day trips by the Section on Geology and Geography to places of interest in the immediate vicinity of Minneapolis; a visit by the Plant Physiologists to the laboratories of the Shelter Belt project of the Lake States Forest Experiment Station; and a visit by the American Meteorological Society to Fort Snelling, where meteorological observations, since continued, were commenced in 1819. If the number warrants, the Section on Anthropology will make a three-day trip to outstanding archeological sites, notably those of Pleistocene Man in Minnesota, with an archeologist or a geologist in charge.

Section Meetings and Society Programs

The Section on Mathematics (A) and the Section on Physics (B) will hold a joint symposium on Tuesday morning on the general subject of methods of solution of differential equations and illustrations of their application to problems in mathematical physics. Papers will be presented by Professor R. W. Brink (University of Minnesota) on "Boundary Value Problems"; Professor Rudolph E. Langer (University of Wisconsin) on "The Asymptotic Solution of Differential Equations"; and Professor David M. Dennison (University of Michigan) on "Applications of Approximate Methods to Physical Problems with Particular Reference to Molecular Spectra." On Tuesday afternoon the Section on Physics (B) will meet jointly with the Section on Astronomy (D). A joint luncheon of Sections A, B and D is scheduled for Tuesday. The American Physical Society has arranged to hold its summer meeting in Minneapolis on June 21 and 22, just prior to the opening of the meetings of the association.

The American Meteorological Society will hold sessions on Thursday, Friday and Saturday. The outstanding feature of the meeting will be descriptions of methods of controlling or mitigating the effects of weather. The interrelations of climate and forests and the proposed Shelter Belt, the prevention of soil erosion and the construction and management of the nine-foot channel of the Mississippi will be the subjects of invited papers by Raphael Zon and Carlos G. Bates, consultants for the Shelter Belt, by Walter J. Parsons and George O. Guesmer, of the U. S. District Engineer Office, St. Paul, and O. R. Zeasman, in charge of erosion control work in Wisconsin. A session devoted to the work of the cooperative climatological observers of the Weather Bureau will be held on Saturday, to which all these observers in the upper Mississippi Valley and Northwest have been invited. Arrangements are being made for a visit to Fort Snelling, where meteorological observations, commenced in October, 1819, have been carried on continuously since that date.

The Section on Chemistry (C) plans to have a symposium on physiological chemistry, probably on the processes of the digestive tract, in cooperation with the Section on Medical Sciences. Also the section will have one or two general sessions, depending on the number of contributions, devoted to general papers in the field of chemistry. The Minnesota Section of the American Chemical Society is cooperating with Section C and will invite the state sections from neighboring states to meet jointly with the section. At least one of the national chemical fraternities will hold its annual meeting in Minneapolis at the same time as the association meeting.

The Section on Astronomy (D) will meet with the Section on Physics (B) in a joint session on Tuesday afternoon, at which Dr. Otto Struve, director of the Yerkes Observatory, will give the principal address on the subject "Modern Interpretations of Spectra." This will be followed by a session for contributed papers. Additional sessions for the presentation of papers may also be scheduled. The offices of the Department of Astronomy of the University of Minnesota will be open to all visitors, who are cordially invited to come and inspect the work that is being done. A joint luncheon is planned for Tuesday noon with Sections A and B.

The Section on Geology and Geography (E) plans a meeting for presentation of papers Thursday morning, also joint sessions with the Section on Anthropology (H). Half-day field trips to places of interest in the immediate vicinity of Minneapolis are in mind. The department of geography of the University of Minnesota is considering a field excursion. The Society for Research on Meteorites has sessions on Wednesday and Thursday which will interest geologists. It may be that the Eastern Section of the

Seismological Society of America will also hold a meeting in Minneapolis at this time.

The Section on Zoological Sciences (F) will present a symposium on hormones on Wednesday morning. In the afternoon the section will meet jointly with the Ecological Society of America for a field trip to sand dunes in the vicinity of the Twin Cities. Thursday morning's session will give place to the association program on conservation. On Friday the American Society of Parasitologists will conduct jointly with the Section on Medical Sciences a program of invited papers in the field of animal parasitology. Among these papers are one on North American and other ticks in relation to the transmission of Rocky Mountain spotted fever, and others by prominent investigators on "Characteristics of *Diphyllobothrium latum* in Canada," "Problems in the Study of Onchocerciasis," "The Rickettsia-like Microorganism of *Culex pipiens*," "The Rôle of Fleas and Ticks in the Spread of Tularemia," "The Significance of Recent Studies on Lung Flukes in the United States," "The Life Cycle of *Prosthagonimus macrorchis*," "The Zoology of Cercarial Dermatitis," "Stages in the Life History of *Spiroryx contortus*," "The Use of Calcium Chloride in Parasitological Technique" and "The Fox Lungworm, *Cepillaria aerophila*." This will be followed by an afternoon program of demonstrations by the American Society of Parasitologists, for which an extensive series of unusual exhibits is pledged.

The Section on Botanical Sciences (G), in cooperation with the Botanical Society of America and other botanical organizations, will hold a session on Monday evening with one or two invited papers, followed by a reception or smoker. A program of invited papers is scheduled for Tuesday morning, and a field trip, either to the Minnesota River Valley or the St. Croix River Valley, for Tuesday afternoon, a trip to the Bunker Prairie region for Wednesday and a trip to the Cloquet-Duluth region for Thursday and Friday. Tuesday and Wednesday evenings are to be devoted to informal discussions, with possibly a dinner on Tuesday evening. The American Society of Plant Physiologists will participate in three joint sessions as follows: with the Botanical Society of America on Monday afternoon; on Tuesday morning with the Section on Agriculture in a symposium on "Improving the Germplasm of Domestic Plants and Animals," with addresses by Dean W. C. Coffey, Hon. H. A. Wallace, Dr. Jay L. Lush and F. D. Richey; and on Wednesday afternoon with the American Society for Horticultural Science, followed by a field trip to the University Fruit Breeding Farm. A session for the presentation of papers will be held on Wednesday morning, followed by a symposium on dormancy, after-ripening and germination of seeds. On Thursday and Friday the Physiologists will join the Botanists in their field trip to Itasca State Park, the Cloquet Forest Experiment Station and the North Shore of Lake Superior. Their program also includes inspection of laboratories and demonstrations of research work in progress in the physiological laboratory of the University of Minnesota Department of Botany as well as the Section of Plant Physiology at the University Farm, and also laboratories of the Shelter Belt project of the Lake States Forest Experiment Station.

The Ecological Society of America, under the joint auspices of the Sections on Botany and Zoology, plans to hold a session on Tuesday morning with invited papers dealing with local flora and fauna. The Ecologists will join the Botanists in their field trip on Tuesday afternoon to the Minnesota River Valley, where are to be found a typical forest of the region, wet meadows and seepage bogs at the base of bluffs, with unusual vegetation. An all-day field trip is planned for Wednesday, either with the Botanical Society to the Anoka Sand Plain, or with the Zoologists and Animal Ecologists. On Thursday and Friday the Ecologists will join the Botanists in their trip to northern Minnesota.

The Section on Anthropology (H) will hold three morning sessions. On Thursday the session will be devoted to the discussion of archeological problems of the Upper Mississippi area. Dr. A. E. Jenks will discuss Pleistocene Man in Minnesota, L. A. Wilford will present data on Minnesota prehistory, and A. W. Bowers will talk on the archeology of the Dakotas. At the Friday session the principal speaker will be Mark L. Burns, an Indian agent in charge of the Great Lakes area, who will present an outline of government policy in this area. Dr. Florence Goodenough will discuss primitive mentality and Miss Frances Densmore will read a paper on Indian songs. Dr. W. M. Krogman will give an illustrated talk on proto-historic and early historic races of Asia Minor. The Saturday session will be given over to child-growth studies. Dr. R. E. Scammon will discuss growth trends, Dr. W. D. Wallis will read a paper on anatomic growth-rate, and Dr. C. H. McCloy will outline the statistical approach to the analysis of growth factors at varying ages. The afternoons have been left open to provide an opportunity to study the important archeological material housed in the department of anthropology of the University of Minnesota, under the care of Professor A. E. Jenks. In addition there will be time to visit archeological sites on the outskirts of Minneapolis. If the number warrants, a three-day trip to outstanding archeological sites, notably those of Pleistocene Man in Minnesota, will be arranged, with an archeologist and a geologist in charge.

The Section on Psychology (I) will meet jointly

with the Section on Education (Q) on Friday morning in a session for contributed papers. On Thursday evening these sections will participate in a dinner held under the auspices of Phi Delta Kappa and Pi Lambda Theta, at which Professor John E. Anderson (University of Minnesota) and Professor F. B. Knight (University of Iowa) will deliver addresses. On Saturday Section I will hold a session for the discussion of "The Measurement of Attitudes."

The Section on Social and Economic Sciences (K) will hold morning sessions on Tuesday, Wednesday and probably also Thursday for the presentation of papers among which are the following: (1) "The Effect of the Depression on Mortality and Morbidity," by Dr. Louis Dublin; (2) "Recent Population Movements," by Dr. Carter Goodrich, from the S. S. R. C. study of this problem; (3) "Income Redistribution," by some one from the Brookings Institution; (4) "Land Use and Its Effect on Population Trends," by Professors Kolb and Nowell, of the University of Wisconsin; (5) "The Fertility of Families on Relief," by Dr. Clark Tibbitts, of Chicago; (6) "Housing Problems," by Professor James Ford, or "Basic Studies Behind Housing," by Shelby Harrison. The American Sociological Society is cooperating.

The Section on Medical Sciences (N) has arranged a comprehensive program, including both general and special subjects, and will hold sessions on the mornings of Monday, Tuesday, Wednesday, Thursday and Friday, the Monday, Tuesday and Friday session to be joint meetings with the Section on Chemistry (C), the Minnesota State Medical Association and with the Zoologists and Parasitologists, respectively.

The joint session with the Section on Chemistry (C) on Monday will include papers dealing with the chemistry of certain hormones and other subjects. The joint session with the Minnesota State Medical Association on Tuesday morning will consist of a symposium on "Diseases of the Blood." The subject of "Agranulocytosis" will be discussed by Dr. Theodore L. Squier of Milwaukee. Dr. Walter A. Bloedorn, School of Medicine, the George Washington University, Washington, D. C., will discuss "Iron Therapy," and Dr. William P. Murphy, Harvard Medical School, Boston, Massachusetts, will discuss "Liver Treatment." After the scientific demonstrations and exhibits have been presented Dr. Louis W. Sauer, of Northwestern University Medical School, will speak on "The Prevention of Whooping Cough with Bacillus Pertussis Vaccine." On Wednesday morning Section N will have a group of interesting papers covering various subjects.

On Thursday morning, June 27, Section N will hold its meeting at the Mayo Foundation in Rochester, Minnesota. Dr. William J. Mayo will welcome the visitors to the Mayo Clinic and interesting papers will be presented by members of the staff of the Mayo Clinic and visiting scientists, including Professor L. H. Newburgh, of the University of Michigan, and Professor E. L. Sevringhaus, of the Medical School of the University of Wisconsin. The afternoon will be devoted to visiting the Experimental Institute, the Hygienic Museum and the General Offices of the Mayo Foundation.

On Thursday morning, while Section N is meeting in Rochester, there will be a meeting of the subsection on Pharmacy in Minneapolis, at which several interesting papers will be presented.

On Friday morning the joint program with the American Society of Parasitologists will include papers by Dr. R. R. Parker, U. S. P. H. S., Dr. R. A. Wardle, the University of Manitoba, Dr. Richard P. Strong, Harvard Medical School, Dr. Marshall Hertig, Harvard Medical School, Dr. R. G. Green, University of Minnesota, and Dr. D. J. Ameel, Augustana College, South Dakota.

Of especial interest to members of the Section on Medical Sciences will be the exhibits and demonstrations of the Minnesota State Medical Association mentioned elsewhere. These are shown in the Minneapolis Municipal Auditorium from 10 to 12 and 2 to 3 Monday and Tuesday. The badge of the A. A. A. S. will serve for admittance. In addition to the commercial displays there will be a large number of scientific displays sponsored by the University of Minnesota, the American Medical Association, the Mayo Foundation, the Council on Physical Therapy, and smaller displays on the treatment of pediatrics, carbon monoxide poisoning, injection treatment of hernia, diabetes and a special heart exhibit. The Friday afternoon program of exhibits and demonstrations by the American Society of Parasitologists will also be of interest to members of the Section on Medical Sciences. Full details regarding both series of exhibits will be found in the final program.

The Section on Agriculture (O) will hold a joint symposium on Tuesday morning in cooperation with the Dairy Science Association, the Corn Belt Section of the American Society of Agronomy, the American Society for Horticultural Science (Great Plains Section), the American Phytopathological Society, the Genetics Society of America and the American Society of Plant Physiologists, on the subject, "Improving the Germ Plasm of Domestic Plants and Animals." Professor H. K. Hayes, vice-president of the section, will preside. The introductory address will be given by Dean W. C. Coffey, of the University of Minnesota department of agriculture. The Honorable Henry A. Wallace will speak on the subject "Future Possibilities," and Dr. Jay L. Lush, of Iowa State College, will discuss "Some Accomplishments with Animals." Dr. O. S. Aamodt, of the University of

Wisconsin, will talk about "Analysis and Synthesis in the Development of New Varieties of Plants." A field trip to Moserip's Farm, Lake Elmo, to observe studies of pasture management, has been arranged for Tuesday afternoon. On Wednesday the section will cooperate with the Phytopathologists, Geneticists and Plant Physiologists in a field trip to observe the work of the divisions of agronomy and plant genetics and plant pathology and botany of the University of Minnesota at University Farm. Thursday morning will be devoted to a field trip to Lake Mille Lacs, with visits en route at the High-lime Peat Experimental Field at Coon Creek and the Low-lime Peat Experimental Field at Page, twelve miles south of Lake Mille Lacs.

The Section on Education (Q) will hold four sessions, on Thursday and Friday morning and afternoon, for the presentation of reports on research studies on (1) school administration, (2) the improving of learning, (3) understanding the young child and (4) higher education. On Thursday evening the section will participate in a dinner held under the auspices of Phi Delta Kappa and Pi Lambda Theta, at which Professor F. B. Knight (University of Iowa) and Professor John E. Anderson (University of Minnesota) will speak.

A DINNER DEMONSTRATION OF THRESHOLD DIFFERENCES IN TASTE AND SMELL

By Dr. ALBERT F. BLAKESLEE

DEPARTMENT OF GENETICS, CARNEGIE INSTITUTION OF WASHINGTON, COLD SPRING HARBOR, N. Y.

MEAL-TIME is distinctly a time of taste and smell. However great may be the appeal to the eye or to the ear in the dinner accompaniments, the primary appeal of food is to the senses of gustation and olfaction. At meal-time one is most ready to try experiments that involve the senses associated with the consumption of our daily bread. The fact that at table the senses in question may be washed, as a slate, clean for a new test by so simple a procedure as a morsel of food and a drink of water is an added reason why a dinner offers a favorable opportunity for a demonstration of peculiarities in taste and smell.

The specific occasion about which the editor of SCIENCE has requested a brief account was the biologist's dinner at the Berkeley meeting of the A_3S this past June. The demonstration was made possible by the cooperation of the management of the International House, where the dinner was held, as well as by that of Dr. A. E. Clarke, who had charge of assembling and distributing the test material and of recording the reactions as expressed by a showing of hands. Since nearly 250 persons were present at the dinner it was not possible in the time available to obtain an accurate record in any instance and, in consequence, some of the estimates given below have been reached with the aid of tests made at other times. The showing of hands adequately fulfilled its chief purpose, however, which was to demonstrate how different people may be in their reactions to the same stimuli.

The first test was called a "preservative cocktail," which was sipped by the diners before they were served with a conventional fruit cup. It consisted of a 0.1 per cent. solution of benzoate of soda served in paper cups in lieu of wine glasses. This is the concentration used commercially in the preservation of food. The majority found it tasteless, but to over a quarter of those tested, however, it had a distinct taste which was described for the most part as sweet or bitter. A larger proportion are able to taste the dry powder, but this compound has been advertised as a tasteless substance, which it is to some, but not to others.

Following the fruit cup, each was given two glassine envelopes marked respectively 0.02 per cent. and 0.64 per cent. The first contained a slip of paper tape which had been dried after being passed through a 0.02 per cent. alcoholic solution of PTC (phenyl-thiocarbamide). The second paper had been treated with a 0.64 per cent. solution and was 32 times stronger. The first paper was without taste to the majority and tasted by only about a quarter of the people. The second stronger paper was tasted by the majority and was without taste to only about 15 per cent. This test was given to show that a substance must have a certain strength of concentration before it can be tasted and that this concentration is different for different people. In other words, people differ in their taste thresholds. They differ also in the kind of sensation which they appear to get from a substance which they taste. PTC, for example, is bitter to most tasters, but a considerable proportion of people report other tastes. In an exhibit at the American Museum of Natural History in connection with the Eugenics Congress in 1932, an opportunity was given for visitors to record on a voting machine what taste, if any, they got from paper impregnated with a medium concentration of PTC. Of the 6,377 who voted, 1,296, or 20.3 per cent., were non-tasters and 5,081, or 79.7 per cent., were tasters. The latter reported their tastes as follows:

Bitter	Sour	Sweet	Salty	Other tastes
4,168 (65.4 per cent.)	346 (5.4 per cent.)	134 (2.1 per cent.)	309 (4.8 per cent.)	124 (1.9 per cent.)

Among the other tastes reported were bitter almonds, camphor and sulfur, which are really odors.

Some of those who attributed sour, sweet or salty to PTC were tested and found able to recognize these tastes as well as bitter in test solutions of other substances. A considerable number of people, however, can not discriminate between some of the primary tastes. Many people, for example, get the same sensation from what most of us call bitter and sour.

It has been shown by others, as well as by the writer, that differences in ability to taste PTC are innate and hereditary. There is no reason to believe that differences in ability to taste other substances are not also innate and hereditary, although PTC is the only one so far tested genetically.

Following the soup, the tables were supplied with "tabloids" of the rare sugar mannose which had been prepared through the kindness of Dr. C. S. Leonard, director of the Burroughs Wellcome Research Laboratories. Each contained 5 mg mannose and 5 mg feculose, a tasteless starchy binder. About 15 per cent. found them entirely tasteless, 20 per cent. found them sweet only, 10 per cent. found them bitter only, while 55 per cent. got both a sweet and a bitter taste. To most of the latter the sweet comes first, but to some the bitter sensation preceded the sweet. To some who were negative to PTC, it was a satisfaction to find they could taste both the sweet and the bitter in mannose, while some of the tasters of PTC failed to perceive one or both of the two tastes of this peculiar sugar. There appears to be little correlation between a person's ability to taste two different kinds of bitter. If the tabloids had been made to contain a different proportion of mannose and feculose, the proportion of tasters and non-tasters would have been different as well as the proportion of those who tasted both the sweet and the bitter. Perception of sweet and bitter in mannose depends upon individual thresholds, which may be different for these two sensations.

Following the roast, instead of a taste test, which might have interfered with the succeeding test, there was interpolated, out of its logical sequence, an odor demonstration which will be discussed later.

The salad consisted of Globe artichokes with mayonnaise dressing and was a taste test in itself. After eating artichokes, 40 per cent. found that water was unchanged in taste, while 60 per cent. found water tasted different. To most, this taste was sweet. The taste reactions to water following artichokes were found to have no close relation to reactions to PTC or to mannose, which had been tried earlier in the meal. No response has yet come to the request that was made for information as to what the chemical substance might be in artichokes which was responsible for the after-taste of the water. There is some evidence suggesting that certain methods of cooking may prevent the reaction. Thus, Globe artichokes cooked with baking soda failed to elicit the reaction in a subject who is regularly positive, and negative reactions have been obtained from the preserved hearts of artichokes which are sold in bottles.

During the remainder of the dinner and after the coffee, demonstrations were given of differences in reactions to odors. Flowers of a cultivated variety of snapdragons (Antirrhinum) and of the Golden Gleam Nasturtium had been supplied as individual table decorations and provided objects more attractive to the eyes than they were to the noses of some of the diners. Each flower was graded according to the strength of its odor as odor absent, weak, medium or strong and in regard to the feelings which it aroused as pleasant, indifferent or unpleasant. About a quarter could detect no odor in the snapdragon and the rest found the odor weak or of only medium strength in contrast to the nasturtiums, which to most were strong or of medium strength, with only a few calling the odor weak. Connected probably with this difference in the strength of odor in the two flowers, a higher proportion of the people considered the odor of the snapdragon pleasant than the proportion which found the nasturtium fragrant and a larger number considered the odor of the latter disagreeable than found the snapdragon to be unpleasant. Certain other flowers[1] with which the writer has experimented appear better adapted to showing differences in smell reactions, but almost any flower with not too strong an odor will disclose some who can not smell it if enough people are tested. A person who is unable to detect fragrance in one kind of flower may be keen in detecting fragrance in other flowers.

Some peculiar reactions to certain natural odors have been reported. Thus, several persons have told the writer they could not smell the odor of skunk even when it appeared strong to others, in one case after running over the source of the odor. One person confessed that he really liked the odor when it was not too strong.

Better than flowers and natural odors for testing people are known chemical substances, the concentration of which can be controlled at least roughly. Folded pieces of filter paper are conveniently kept for several days in a sealed jar with a measured quantity of an alcoholic solution of the odorous substance and assembled in glassine envelopes shortly before the

[1] A. F. Blakeslee, *The Nat. Hort. Mag.*, 11: 211–212, July, 1932.

demonstration. Vanillin and synthetic musk retain their odor in the paper for a considerable time and by adjusting the concentration a group can be separated as desired into a large or into a small proportion of smellers as contrasted with non-smellers. It is readily shown that smell is like taste in that people differ greatly in respect to the threshold at which they can first detect the odorous substance. Smell differs from taste, however, in several respects. There are only a few fairly well-defined categories into which people can classify their tastes, but for their olfactory sensations clear-cut classification seems to be impossible. Odors, in consequence, are generally described in terms of other odors and even of tastes, such as sweet and sour.

Moreover, people differ greatly in the way in which they described a given odor when they compare it with known odorous substances. This is well shown by cuminol, which is variously described by different people as smelling like citrus rind, caraway seeds, crushed bugs, roses, perspiration and other things fragrant or otherwise. This wide range of reactions to cuminol was kindly pointed out to us by Mr. H. S. Redgrove, but caprillic alcohol has somewhat the same odor and we have found it to elicit similar reactions of nearly as wide a range. Many have difficulty in recognizing what kind of perfume they are smelling unless they see the name on the bottle or the flower from which the odor comes. Both cuminol and caprillic alcohol are good reagents also with which to show the differences between people in regard to their emotional response to an odor. The concentration of cuminol on the papers brought to Berkeley was such that about as many found the odor pleasant as those who found it unpleasant. By making the odor stronger or weaker in other demonstrations we have found a larger or smaller proportion who had unpleasant reactions. It was obvious that concentration of odor has much to do with our likes or dislikes. Strong odors are generally unpleasant but, since people differ in thresholds, what is strong to one is weak to another.

Odors are also tied up with associations that make them pleasant or unpleasant, apart from their strength. Associations, conscious or unconscious, probably are the most important factors in making an odor agreeable or disagreeable, as can be realized by one's reactions to odors that are purely personal.

Smell differs from taste again in that the olfactory powers appear dulled with age, and cases are not rare in which the sense of smell has become entirely lost. Several parents have told the writer that certain of their children when young, by smelling a handkerchief they had picked up, were able to tell to which member of the family it belonged, but that this ability had been lost after they had grown up. The writer knows a child personally who surprised his family by recognizing clothes as belonging to a playmate after they had been mixed up in the wash returned from the laundry, but his sense of smell is not unusually keen now in his early twenties. The organs of smell may be temporarily put out of commission by environmental factors, such as a cold in the head or olfactory fatigue. The taste reactions are probably more constant for a given individual, although recent studies indicate that taste acuity may change considerably from one time to another.[2]

Flavors are really odors and to be perceived must be volatile. Unlike the four primary tastes—bitter, sour, sweet and salt, flavors are supposed not to be perceived when the nose is closed. The diners were asked to hold the nose while putting into the mouth a pastille of Bittra chocolate and to note all the sensations resulting. To most, no taste of chocolate (really an odor) was evident until the nose was opened but, as is always the case in such demonstrations, a considerable number reported the chocolate flavor while the nose was still closed. Those with a low threshold (*i.e.*, acute tasters) for bitterness in chocolate could detect the bitter taste in the confection that was not evident to others. A further difference between people was disclosed by the fact that a considerable number could detect no sweetness while the nose was closed, but the sweetness was evident as soon as the nose was opened. The reason for this unexpected result is not yet clear. It has been of regular occurrence whenever groups of people have been tested with confections in this way. "Lifesaver" tablets are convenient objects with which to show different reactions to tastes, flavors and other sensations connected with eating. Sour as well as sweet can be differentiated as tastes in distinction to the flavor in orange or lemon lozenges, for example. Peppermint and wintergreen in addition to the flavor produce a sensation which is variously described as hot or cooling. This can be shown to be neither an odor nor a taste, if we limit this last term to the four primary tastes—bitter, sour, sweet and salt—as most authors believe we should. Hot tamales of our southern neighbors owe their hotness to red pepper, the heat of which is neither smelled nor tasted, properly speaking. Although we purchase pure tastes in the form of sugar, table salt, the acetic acid of vinegar and the bitter constituents of beer and some other drinks, most of the money spent to satisfy our appetites is expended for odors in the form of flavors and for other mouth sensations not properly classified in the category of taste.

Those who had seen how differently from themselves

[2] T. N. Salmon and A. F. Blakeslee, *Proc. Nat. Acad. Sci.*, 21: 78–83, Feb., 1935; A. F. Blakeslee and T. N. Salmon, *Proc. Nat. Acad. Sci.*, 21: 84–90, Feb., 1935.

others had reacted to the tests were perhaps a trifle more inclined to be tolerant of the opinions of other people. From the differences in taste and smell which they had seen in respect to a relatively few substances they could believe the statement that no two people are exactly alike in their sensory reactions and probably never have been. Training and other environmental factors do have an influence on human perceptions and behavior, but it is safe to say that judgments of drinkers regarding the taste of beer and judgments of the Supreme Court regarding issues of law can not help differing because men are born different.

SCIENTIFIC EVENTS

THE NORWICH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE annual meeting of the British Association for the Advancement of Science will be held at Norwich from September 4 to 11, under the presidency of Professor W. W. Watts. The only previous meeting of the British Association in the city of Norwich was in 1868 under the presidency of Dr. Joseph D. Hooker.

The inaugural general meeting will take place at 8:30 P. M. on Wednesday evening, September 4, when Professor Watts will deliver the presidential address, on "Form, Drift and Rhythm of the Continents."

The presidents of the sections and titles of their addresses are as follows:

Section A (Mathematical and Physical Sciences): Dr. F. W. Aston, "The Story of Isotopes."

Section B (Chemistry): Professor W. N. Haworth, subject to be announced.

Section C (Geology): Professor G. Hickling, "Some Aspects of Coal Research."

Section D (Zoology): Professor F. Balfour Browne, "The Species Problem."

Section E (Geography): Professor F. Debenham, "Some Aspects of the Polar Regions."

Section F (Economic Science and Statistics): Professor J. G. Smith, "Economic Nationalism and Foreign Trade."

Section G (Engineering): J. S. Wilson, "Stability of Structures."

Section H (Anthropology): Sir Arthur Smith Woodward, "Recent Progress in the Study of Early Man."

Section I (Physiology): Professor P. T. Herring, "The Pituitary Body and the Diencephalon."

Section J (Psychology): Dr. Ll. Wynn Jones, "Personality and Age."

Section K (Botany): F. T. Brooks, "Some Aspects of Plant Pathology."

Section L (Education): Dr. A. W. Pickard-Cambridge, "Education and Freedom."

Section M (Agriculture): Dr. J. A. Venn, "The Financial and Economic Results of State Control in Agriculture."

An evening discourse will be delivered on September 6, by Dr. S. J. Davies, dealing with "Diesel Engines in Relation to Coastwise Shipping." A second evening discourse will be delivered on September 10, by Dr. C. S. Myers, on "The Help of Psychology in the Choice of a Career."

The Lord Mayor of Norwich, P. W. Jewson, and the Lady Mayoress will give a reception in the Castle Museum on the evening of September 5, and a garden party at Crown Point will be given during the week by H. M. Lieutenant for Norfolk, Russell J. Colman, and Mrs. Colman.

September 7 has been reserved for general excursions to places of interest, schools and industrial firms in the neighborhood of Norwich. Preceding the meeting a geological excursion of four days' duration under the direction of Professor P. G. H. Boswell is being arranged to examine the coastal and inland sections in Norfolk from Hunstanton (Lower Greensand, Red Chalk, Lower Chalk) *via* Morston (purple boulder clay and raised beach) and Weybourne (Weybourne Crag) to Cromer and Bacton (Cromer Forest Beds, Scandinavian Drift and Chalky Boulder Clay).

The societies in correspondence with the association consist of (*a*) Affiliated Societies undertaking local scientific investigations and publishing the results; and (*b*) Associated Societies of at least three years' standing, and not fewer than fifty members, formed for the purpose of encouraging the study of science.

Delegates of the Corresponding Societies will meet on September 5 and 10 to discuss matters of common interest to the societies and the association. The presidential address, by Professor P. G. H. Boswell, will deal with town and country planning.

Future annual meetings will be held as follows: 1936, in Blackpool; 1937, in Nottingham; 1938, in Cambridge.

INTERNATIONAL BIOLOGICAL CONGRESSES

UNDER authorization of the national entomological societies and of Section F of the American Association for the Advancement of Science, arrangements have been made with certain steamship companies for the transportation of those going from America to the Entomological and Zoological Congresses. These arrangements and certain European tours in advance of the congresses are also open to those attending the other congresses, or their friends, or to the university public in general. The European excursions will be as follows:

A. Mediterranean, Adriatic and Black Sea Cruise, followed by a tour of Morocco, Spain and Portugal, June 29 to October 3. $675, tourist class, and up.

B. Kayak trip on German rivers, followed by tour of Morocco, Spain and Portugal, June 29 to October 3. $575, third class; $700, tourist class.

C. Paris, to Rhine, the Black Forest, the Alps, Italy and Madrid, August 13 to September 21. Considerably less than $500, tourist class.

Particulars in regard to steamboat and railroad rates for the congresses on physiology, botany, entomology, zoology and neurology are given below. Reservations and further details can be obtained for Excursion C: Professor P. W. Claassen, Cornell University, Ithaca, N. Y. For other excursions and steamship bookings: Professor J. C. Bradley, 322 E. State St., Ithaca, N. Y.

The Fifteenth International Physiological Congress, Leningrad and Moscow, August 8–18. Arrangements within Russia, including numerous excursions, are in the charge of Intourist, Inc. It should be noted that passengers can be booked through to Leningrad and from Moscow for any Atlantic steamer and port (tourist, special or third class) for very much less than it would cost to book to the terminus of the steamer and then to buy rail tickets to and from Russia.

The Sixth International Botanical Congress, Amsterdam, September 2–7. The official steamer eastbound is the *SS. Statendam,* sailing on August 13. No particular steamer has been set aside for return. Botanists wishing to return with the entomological group may join the *Rex* at Nice (Villefranche) on September 13. The rates are the same as from Gibraltar.

The Sixth International Congress of Entomology, Madrid, September 6–12. Several interesting excursions are announced. Those going directly to the congress will sail on the *SS. Roma* on August 24, or the *SS. Rex* on August 31, according to the date finally fixed for the congress. The return will be on the *Rex* on September 16.

The Twelfth International Zoological Congress, Lisbon, September 14–21. The organizing committee announces reduction in French and Portuguese rail rates and in hotel rates. They also announce attractive excursions. Those going directly to and from this congress will sail on the *SS. Rex* on August 31, returning on *SS. Conte di Savoia,* sailing on September 27 from Gibraltar.

The Second International Neurological Congress, London, July 29 to August 2.

THE HAYDEN PLANETARIUM OF THE AMERICAN MUSEUM OF NATURAL HISTORY

THE Hayden Planetarium of the American Museum of Natural History is fast assuming its final form. The exterior of the square brick building at the corner of 81st Street and Central Park West is practically finished. The copper dome—the outer dome—is entirely completed, and has already been so treated that it has taken on its permanent greenish color. The Park Department of the City of New York is making extensive preparations to beautify the grounds in which the planetarium stands, as well as to provide adjacent parking space for about one hundred cars. New trees and shrubbery are being planted, and a semicircular driveway approach from 81st Street constructed past the entrance to the building.

Work is also progressing very rapidly on the interior of the building. The circular chamber on the first floor, which is to house the Copernican Planetarium, will soon be ready for the instrument which is now receiving the final touches in the workshop of J. W. Fecker in Pittsburgh. This planetarium, which shows the solar system as it would appear if the sun and earth and the other planets were viewed from a distance off in space, is to be installed on the ceiling of this first-floor room. The sun is represented by a lighted globe and the planets and satellites by spheres which revolve on tracks around the sun. It is planned, eventually, to place around the walls of this hall various astronomical murals.

The second-floor hall, with its great 75-foot dome, the very top of which is some forty-seven feet from the floor, was built for the Zeiss Projection Planetarium. This planetarium shows the various aspects and phenomena of the sky as they appear to man as he stands and gazes from his earth out into space. The instrument, itself, which looks like a great dumbbell pivoting at the center, is in reality an aggregation of over one hundred stereopticon machines which project on the dome overhead the semblance of the night sky. This dome is of perforated stainless steel, a type of material which has proved very satisfactory in improving acoustical properties, which are always a problem in a round room. At the time of writing, this dome is completely finished with the exception of its final coating of white paint.

The silhouette of the New York City sky-line which is cut out of the bottom row of the stainless steel plates (about ten feet above the floor), was copied from photographs taken in Central Park of the entire city sky-line as it is seen from that point. Back of this cut-out silhouette the wall is painted black, so the stars, when they reach the buildings, disappear naturally into the blackness, and likewise into the blackness of the oblique baffles at the side and just below the silhouette. This does away with the embarrassing difficulty of having the stars slide down over the fronts of the buildings in the silhouette and down the sidewalls, as they would do if these were of solid material instead of baffles.

It is hoped that the planetarium will be open to the public by the middle of September, although it is possible that later this date may have to be moved to

early October. By the middle of June the second-floor hall can probably be turned over to the Carl Zeiss Company to begin the assembling and installation of the projection instrument which is now crated and in storage in a New York City warehouse. This installation requires at least two months, for it is a delicate job done by special engineers from the Zeiss works in Jena.

One of the most-used entrances to the planetarium will be, no doubt, through the Roosevelt Memorial, that beautiful and stately building which is to form the central unit of the American Museum of Natural History, on Central Park West. Although the Roosevelt Memorial may not be open to the public until November, doorways are now being cut through its walls into the Planetarium, and as soon as both buildings are open, the use of this entrance into the planetarium will greatly facilitate the handling of crowds.

The Planetarium building itself was made possible by a loan of $650,000 from the Reconstruction Finance Corporation, while the two planetarium instruments were given through the generosity of Charles Hayden, for whom the planetarium is named.

CLYDE FISHER,
Curator of Astronomy

HONORS CONFERRED BY THE FRANKLIN INSTITUTE

AT the Medal Day Exercises of The Franklin Institute of the State of Pennsylvania, held in the Hall of the institute, the Parkway at Twentieth Street in Philadelphia, on the afternoon of Wednesday, May 15, seventeen honors which had been awarded during the institute year were presented to their recipients or representatives of them. The medalists were drawn from England as well as from the United States. The awards were as follows:

Certificate of Merit

To George Kelley, of New York City, New York, "in consideration of the invention of an apparatus for the removing of the dust produced in the drilling of rock and the resulting lessening of the silicosis hazard."

The Edward Longstreth Medals

Founded in 1890 by Edward Longstreth, Philadelphia. To Edmond Bruce, of the Bell Telephone Laboratories of Red Bank, N. J., "in consideration of his design and development of antennae for short-wave communication combining superior efficiency, high directivity, simple construction and effectiveness over a broad range of frequencies. . . ." To Howard D. Colman and Burt A. Peterson, of Rockford, Ill., jointly, "in consideration of the signal advance in the art made by the Barber-Colman Automatic Spooler and of the general excellence of its design." To Peter Davey, of New York City, "in consideration of the successful and useful combination of well-known principles embodied in the vibroscope and vibrometer and especially of their combination in a portable balancing device." To Karl B. McEachron, of the General Electric Company, Pittsfield, Mass., "in consideration of his careful conduct of a series of closely controlled investigations extending over a period of six years which resulted in the successful development of a process for manufacturing thyrite."

The John Price Wetherill Medals

Founded in 1925 by the family of the late John Price Wetherill. To Dr. Francis F. Lucas, of the Bell Telephone Laboratories, "in consideration of his development of a technique of microscopy and photomicrography by virtue of which objectives of the highest numerical aperture yet developed and visible light and ultra-violet light have been brought to their full theoretical resolving power, and by the use of which photomicrographs of metallurgical and biological specimens superior to any heretofore made are now being produced under his direction." To Robert E. Naumburg, of New York City, "in recognition of an invention which embodies a meritorious utilization of several well-known mechanical and physical principles to produce an apparatus original in its accomplishments and of unquestioned benefit to humanity." To W. H. Shortt, of Exeter, and F. Hope-Jones, of London, jointly, "in consideration of their respective contributions to the invention, development and production of a free pendulum type of clock of remarkable precision which is now used in standard time control in Great Britain and the United States." To Dr. James E. Shrader, of the Drexel Institute, Philadelphia, "in consideration of the design and construction of a portable and easily operated instrument for the investigation of vibrations, which affords simultaneous records of the vibrations in three mutually rectangular directions and in which the inventor displayed much ingenuity." To Dr. Louis Bryant Tuckerman, of the National Bureau of Standards, "in consideration of the fundamental improvements which he has introduced into the optical lever, making it an instrument of hitherto unrealized precision and of his ingenious application of this lever to a strain gauge." To Henry Ellis Warren, of Ashland, Mass., "in consideration of his invention of the telechron motor—a small, limited-power, self-starting, synchronous motor having strong starting torque and synchronous torque characteristics."

The Walton Clark Medal

Established in 1926 by the United Gas Improvement Company of Philadelphia. To Frederick Joseph West, of Manchester, England, "in consideration of his outstanding service to the gas industry in the sphere of improved scientific development of gas works practise and technique and practical gas research as applied particularly to the carbonization of coal in vertical retorts, and for his work in the training and education of engineers and his success in promoting amicable relationships between employer and employed, all of which have been of substantial value to the manufactured gas industry."

The Louis Edward Levy Medal

Founded in 1923 by the family of Louis E. Levy of Philadelphia. To Dr. H. L. Hazen, of the Massachusetts Institute of Technology, "for his two papers published in the September, 1934, issue of the *Journal* of the Institute and the November, 1934, issue, entitled, respectively, 'Theory of Servo-Mechanisms' and 'Design and Test of a High Performance Servo-Mechanism.'"

The Franklin Medals

Founded in 1914 by Samuel Insull, Esq., of Chicago, Ill. To Dr. Albert Einstein, of the Institute for Advanced Study, Princeton, N. J., "in recognition of his contributions of fundamental importance to theoretical physics, especially his work on relativity and the photo-electric effect." To Sir John Ambrose Fleming, emeritus professor of the University of London, London, Eng., "in recognition of his many contributions to the improvement of the art of communication, and especially the invention of the thermionic valve which bears his name." Sir Ambrose was unable to come to America to receive his medal in person. He was represented by the British Consul General at Philadelphia.

In the evening a subscription dinner was held in honor of the medalists at the Bellevue-Stratford Hotel.

SEMI-CENTENNIAL OF THE AWARD OF THE FIRST ELECTRICAL ENGINEERING DEGREE IN AMERICA

THE Massachusetts Institute of Technology on August 31, 1882, announced its pioneer course, and on June 2, 1885, awarded the first electrical-engineering degree in America. The event will be celebrated at Cambridge on Alumni Day, June 3, by a Semi-Centennial Symposium in which electrical-engineering education in the United States during the past fifty years will be reviewed with particular reference to the influence that the Massachusetts Institute of Technology has had on its development.

The principal speakers will be Dr. F. B. Jewett, '03, president of the Bell Telephone Laboratories, Inc.; Dr. A. A. Potter, '03, dean of engineering at Purdue University, and Dr. Vannevar Bush, '16, vice-president and dean of engineering at the Massachusetts Institute of Technology. Professor D. C. Jackson, head of the department of electrical engineering, will preside.

Following the symposium, a testimonial luncheon will be held in the Walker Memorial for Professor Jackson, who is retiring this year after directing the electrical-engineering division for twenty-eight years. The speakers at the luncheon will include: Herbert G. Pratt, '85, president of the Samson Cordage Works; C. A. Stone, '88, chairman of the board, Stone and Webster, Inc.; Gerard Swope, '95, president of the General Electric Company; Professor W. S. Rodman, '09, dean of engineering at the University of Virginia; Professor O. G. C. Dahl, '21, representing the electrical-engineering faculty at the institute, and Dr. K. T. Compton, president, and E. L. Moreland, '07, who will succeed Professor Jackson as head of the department of electrical engineering. Professor Jackson will respond, and Alexander Macomber, '07, consulting engineer and public-utility executive, will preside.

After the luncheon Professor Jackson, attended by the electrical-engineering faculty, will hold a reception for the guests. In the electrical-engineering laboratories special demonstrations will be made of calculating machines, electrical communication, sound measurement, modern illumination, developments in electronics, stroboscopic measurement, insulation research, electro-physiological research and super high-voltage engineering. A statistical and historical exhibit will illustrate the development of electrical-engineering education at the institute.

RECENT DEATHS

DR. CHARLES HORACE CLAPP, president of the State University of Montana, formerly of the Geological Survey of Canada and of the U. S. Geological Survey, died on May 9 at the age of fifty-two years.

DR. ALFRED E. BURTON, who joined the faculty of the Massachusetts Institute of Technology as instructor of topographical engineering in 1882, becoming professor emeritus in 1922, died on May 11 at the age of seventy-eight years. Dr. Burton served the institute as dean for a period of twenty years.

THE death is announced of H. B. Baker, lately professor of general chemistry in the Imperial College of Science and Technology, London, on April 27 at the age of seventy-three years.

PROFESSOR HECTOR MUNRO MACDONALD, since 1904 professor of mathematics at the University of Aberdeen, died on May 16. He was a fellow of the Royal Society, in whose proceedings his contributions to the mathematical theory of radio were mainly published. He received the society's Royal Medal in 1916. He was also a fellow of the Royal Astronomical Association and president of the London Mathematical Society.

HERBERT HENRY THOMAS, petrographer to the British Geological Survey, died on May 12. He was a former secretary and president of the Geological Society and a former president of Section C of the British Association. In 1925 he won the Murchison Medal of the Geological Society. He was fifty-nine years old.

SCIENTIFIC NOTES AND NEWS

THE Langley Medal for aerodromics of the Smithsonian Institution was presented on May 21 to Dr. Joseph S. Ames, retiring president of the Johns Hopkins University, chairman of the National Advisory Committee for Aeronautics. The presentation was made by Chief Justice Charles E. Hughes, chancellor of the institution, in accordance with a vote of the Board of Regents at their annual meeting in January. The award, as stated in the resolution accompanying the medal, was "in recognition of the surpassing improvement of the performance, efficiency and safety of American aircraft resulting from the fundamental scientific researches conducted by the National Advisory Committee for Aeronautics under the leadership of Dr. Ames."

THE Chalmers Medal of the Royal Society of Tropical Medicine and Hygiene has been awarded to Professor William H. Taliaferro, head of the department of hygiene and bacteriology of the University of Chicago, "in recognition of his valuable contributions to knowledge of the subject of animal immunity." The Chalmers Medal is granted every two years to a man under forty-five years of age who has "contributed signally" to research in tropical medicine.

THE American Section of the Society of Chemical Industry announces that the Chemical Industry Medal for 1935 has been awarded to Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research at Pittsburgh, Pa. This award is made annually to a person who has made a valuable application of chemical research to industry, primary consideration being given to applications in the public interest. Presentation of the medal will be made at a meeting of the Society of Chemical Industry in the fall.

THE Schoellkopf Medal for 1935 was presented on May 7 at the meeting of the Western New York Section of the American Chemical Society to F. A. Lidbury, president and general manager of the Oldbury Electro-Chemical Co., Niagara Falls, N. Y., for his "contributions to the science of electrochemistry and his many-sided activities, both as chemist and executive, in the service of the American chemical industry."

THE Leslie Dana Gold Medal of the National Society for the Prevention of Blindness was presented to Dr. William H. Wilder, emeritus professor of ophthalmology, Rush Medical College, Chicago, at ceremonies in St. Louis on May 18. Dr. Wilder was selected for the award, in recognition of his work in the conservation of vision, by the national society in cooperation with the St. Louis society.

A TESTIMONIAL dinner was given recently by former students and members of his department to Dr. John E. Ostrander, retiring head of the department of mathematics of the Massachusetts State College. He was presented with a bound volume of letters from students whom he had taught during the thirty-seven years of his professorship. Dr. Clarence E. Gordon, head of the division of physical and biological sciences, acted as toastmaster. Among those who spoke were: Dr. Hugh P. Baker, president of the college; Philip F. Whitmore, of Sunderland, member of the Board of Trustees; Dixon R. Fox, president of Union College, of which Dr. Ostrander is an alumnus; Dr. Joseph B. Lindsey, emeritus professor of chemistry; Professor Thomas Esty, of the department of mathematics, Amherst College; Dr. Sidney B. Haskell, president of Synthetic Nitrogen Products Company of New York, until 1927 director of the Massachusetts Experiment Station, and Professor Frank C. Moore, associate professor of mathematics.

DR. CHARLES EDWARD COATES, dean of the College of Pure and Applied Science, received the degree of doctor of laws at the diamond jubilee celebration of the Louisiana State University. The degree was awarded "in recognition of long years of distinguished services in teaching and research, loyal devotion to the university and to the cause of science, faithful efforts to advance the cultural and industrial interests of southern life, contributions through Louisiana State University to the world community; teacher, scholar, scientist, friend of learning and of men."

DR. FRANCIS E. LLOYD, professor of botany emeritus at McGill University, has been elected an honorary fellow of the Botanical Society of Edinburgh.

DR. A. C. SEWARD, professor of botany at the University of Cambridge, has been elected a member of the Norwegian Academy of Science and Letters.

DR. EDWIN G. CONKLIN, professor emeritus of biology, was elected president of the Princeton chapter of Sigma Xi, at the annual meeting of the chapter held on May 17. The principal address was made by Professor Henry Norris Russell, retiring president of the society, on "The Origin of the Planets—an Unsolved Mystery." Other officers for next year will be Professor Luther P. Eisenhart, *vice-president;* Professor Louis A. Turner, *secretary;* Professor Erling Dorf, *treasurer,* and Professor George E. Beggs, *committeeman.*

THE Central New York and Central Pennsylvania branches of the Society of American Bacteriologists will hold a combined meeting at Cornell University,

on Saturday afternoon and evening, May 25. Dr. Karl Meyer, president of the Society of American Bacteriologists, will be the guest speaker.

DR. JAMES F. COUCH, chemist of the Bureau of Animal Industry of the Department of Agriculture and professor of historical science at the National University, has been elected president of the Chemical Society of Washington, D. C.

VINCENT P. GIANELLA has been advanced from associate professor to full professor and head of the department of geology in the Mackay School of Mines of the University of Nevada. Dr. Harry E. Wheeler has been appointed instructor in the department, succeeding Dr. Thomas P. Thayer.

AT Harvard University, Professor Frederick L. Hisaw, of the University of Wisconsin, has been appointed professor of zoology, and Dr. Harry L. Fevold, who has been associated with him at Wisconsin, has been appointed assistant professor of biological chemistry. Dr. Abraham Myerson, of Boston, has been appointed clinical professor of psychiatry.

DR. EARL H. HERRICK, head of the department of biology of the Louisiana State Normal College, has been appointed associate professor of zoology and agricultural experiment station mammalogist in the Kansas State College, to succeed the late Dr. George E. Johnson.

DR. FREDERICK L. HOFFMAN, Philadelphia, consulting statistician of the Prudential Life Insurance Company since 1894, retired from active duty on May 1, at the age of seventy years.

DR. HOWARD B. LEWIS, director of the College of Pharmacy of the University of Michigan and professor of physiological chemistry in the Medical School, has been elected a member of the National Board of Medical Examiners of the United States, to succeed the late Professor Otto Folin, of Harvard University.

DR. GREGORY D. MAHAR, a member of the staff of the Syracuse Department of Health since 1923, has been appointed health commissioner of the city, to succeed Dr. George C. Ruhland, who recently became health commissioner of the District of Columbia.

DR. WALLACE RUDDELL AYKROYD has been appointed by the Governing Body of the Indian Research Fund Association to the post of director of nutritional research under that association.

SIR HENRY LYONS has been appointed chairman of the Advisory Council of the Science Museum, London. He succeeds Sir Richard Glazebrook, formerly chairman, who has resigned.

DR. GEORGE A. HULETT, professor of physical chemistry at Princeton University, was the representative of the American Chemical Society to the fifth National Meeting of Pure and Applied Chemistry, held in Sardinia from May 1 to 7. Dr. William F. Zimmerli, head of the foreign relations department of E. I. du Pont de Nemours and Company, will represent the society at the fifteenth Congress of Industrial Chemistry, which will be held in Brussels, from September 22 to 28.

DR. WILLIAM AUSTIN CANNON, of the department of botany, of Stanford University, is spending the year in Europe. He will visit the leading botanical gardens and laboratories and will be a delegate from Stanford University to the Botanical Congress to be held at Amsterdam in September.

HARRY C. RAVEN, associate curator of comparative and human anatomy at the American Museum of Natural History, has returned from an expedition in Malaya.

AN expedition for the Academy of Natural Sciences of Philadelphia, led by R. R. N. Carpenter, a trustee of the academy, will leave Philadelphia early in June for a six weeks' cruise on the yacht *Westward*, among the islands of southern Alaska, with the object of studying the animals and birds of that region.

DR. IRVING LANGMUIR, director of the Research Laboratory of the General Electric Company, gave a lecture at The Johns Hopkins University on "New Work on Monatomic and Multimolecular Films," on May 10 under the A. R. L. Dohme lectureship in chemistry.

DR. HUGH M. SMITH, who recently returned to the United States after having served for ten years as biological adviser to the Siamese Government, gave a lecture on May 4 before the Washington Biological Society on Siamese zoology. Dr. Maurice C. Hall, of the Bureau of Animal Industry, spoke at the same meeting on "The Application of Military Principles to the Control of Animal Parasites."

PROFESSOR L. B. AREY, of the Northwestern University Medical School, delivered the annual William Snow Miller lecture at the University of Wisconsin on May 2. The title of the address was "Factors that Influence the Course of Wound Healing."

DR. DONALD H. MENZEL, of the Harvard Observatory, spoke before the Richmond (Virginia) Section of the American Chemical Society on April 19 on the subject "Cosmic Chemistry"; on April 22 at Goucher College in Baltimore, and on April 24 at Foxcroft School, Middlebury, Va., he lectured on "Exploring the Universe." At the Leander McCormick Observatory on April 25 he gave a colloquium on "Recent Advances in our Knowledge of the Solar Chromosphere."

THE forty-third annual meeting of the American

Psychological Association will be held from September 4 to 7 at the University of Michigan.

THE summer convention of the American Institute of Electrical Engineers will be held at Cornell University from June 24 to 28.

THE first Congress on Undulant Fever in Men and Animals will be held at Avignon on June 11, 12 and 13. Further information can be obtained from the general secretary, Dr. Joseph Jullien, Joyeuse, Ardèche, France.

Industrial and Engineering Chemistry states that the tentative program of the fifteenth Congress of Industrial Chemistry, to be held in Brussels from September 22 to 28, has been announced. Committees have been appointed and the congress organized in seven groups, which will have to do with organization of factory and laboratory; fuels; mineral and metallurgical industries, materials of construction, glass, ceramics; organic industries (dyes, pharmaceuticals, photographic products, resins, textiles, fats, tanning, etc.); agricultural industries and industrial hygiene. Two prizes are to be offered, of 5,000 Belgian francs each: one for the best paper presented, and the second for the best paper presented by a Belgian author. Full information regarding the congress may be obtained by addressing the Secretary, 132a Boulevard Maurice Lemonnier, Brussels, Belgium. Papers must be received before July 15, and hotel reservations should be made before June 1.

THE sixth lecture in the Smith-Reed-Russell Series for this year at the George Washington University School of Medicine was given on May 14. Dr. Karl F. Meyer, of the George Williams Hooper Foundation, and professor of bacteriology at the University of California, was the guest speaker. The subject of his lecture, which was illustrated with motion pictures, was "Selvatic Plague." In the afternoon the department of bacteriology held a tea and seminar, to which members of the faculty of the Medical School and guests from near-by colleges were invited. Dr. Meyer spoke on "Psittacosis," and again illustrated his talk with motion pictures.

AT the annual meeting of the American Association of Pathologists and Bacteriologists held in New York, the following officers were elected: *President,* Dr. S. B. Wolbach, Boston; *Vice-president,* Dr. N. C. Foot, New York; *Treasurer,* Dr. F. B. Mallory, Boston; *Secretary,* Dr. H. T. Karsner, Cleveland; *Incoming Member of Council,* Dr. C. V. Weller, Ann Arbor. The symposium for the next annual meeting, to be held on April 9 and 10, 1936, in Boston, Mass., in joint session with the American Association of Immunologists, is on "Inflammation." Dr. Arnold R. Rich, of Baltimore, was selected as referee for this symposium. The gold-headed cane of the association was awarded to Dr. Frank Burr Mallory, of Boston.

THE eleventh annual meeting of the New York State Geological Association, held in Utica, N. Y., on May 10 and 11, was attended by one hundred and seventy geologists and advanced students from New York, New Jersey, Pennsylvania, Massachusetts and New Hampshire. At the business meeting, which followed the banquet on the evening of May 10, the following officers were elected: *President,* Professor H. Ries, and *Secretary,* Dr. J. D. Burfoot, both of Cornell University. At the same meeting the association voted to accept the invitation extended by the Pennsylvania Association to meet with them in 1936, somewhere in the anthracite coal district, probably in the vicinity of Scranton, Pa.

DISCUSSION

DIFFERENCE BETWEEN ARITHMETIC AND ALGEBRA

UNDER the term "algebra" in the recently published Webster's "New International Dictionary," second edition, 1935, it is stated that "The essential difference between arithmetic and algebra is that the former deals with concrete quantities, while the latter deals with symbols whose values may be any out of a given number field." Those who are at first inclined to adopt the explanations which appear in such widely used and glowingly advertised works of reference as this dictionary will find it difficult to harmonize this quotation with the well-known fact that such numbers as 1, 2, 3, etc., are abstract, while such numbers as 2 men, 3 horses, etc., are concrete. In particular, our common multiplication tables, which belong to the early part of arithmetic, relate entirely to abstract numbers. The symbols which appear on blocks for children and represent natural numbers relate to just as abstract ideas as those which represent the numbers of a field.

One of the chief objectives of pre-Grecian mathematics was the study of the number field composed of the rational numbers. The difference between algebra and arithmetic noted in the given quotation does not relate to the supposed fact that arithmetic deals with concrete quantities, while algebra deals with symbols representing numbers, but to the fact that algebra deals with symbols which may represent more general

numbers than those commonly used in elementary arithmetic. It is a difference in generalization rather than a difference in abstraction. As we advance in mathematical study we deal continually with more general ideas, but it is questionable whether we deal with relatively more abstract ideas. It would be very difficult to prove that arithmetic deals with relatively more concrete quantities than algebra.

It is well known that the terms arithmetic, algebra, geometry, etc., are somewhat vague and that there is no generally accepted line of division between the subjects represented by them. Mathematics is commonly divided into pure and applied mathematics, but here there is also no commonly accepted line of division. Concrete numbers are frequently considered in elementary algebra as well as in elementary arithmetic. It should be noted that numbers are probably among the earliest abstract notions acquired by the human race and that one of the profoundest facts of mathematical history is the very early development of abstract mathematics. It used to be said that the early Babylonian mathematics was mainly concerned with business arithmetic, but it has recently been emphasized by O. Neugebauer and others that this early mathematics is mainly pure mathematics. The first table in the well-known Egyptian "Rhind Mathematical Papyrus" relates also entirely to abstract mathematics.

A more definitely incorrect statement in this dictionary, which also relates to a subject of wide interest, appears under the term "determinant." It is here stated that the consistency or the inconsistency of a system of n linear equations, in n unknown quantities, depends on the non-vanishing or the vanishing of the determinant of the system. It is well known that the consistency or the inconsistency of a system of linear equations can not be determined by the study of the matrix of the system alone but requires also the consideration of the augmented matrix. As the notation employed by G. W. Leibniz (1646–1716) differs so widely from the one which is now commonly employed to represent a determinant it is questionable whether it should be said that he discovered this subject, as is done here, notwithstanding the fact that this is also commonly done elsewhere. Improvement in knowledge is more important than stability.

G. A. MILLER

UNIVERSITY OF ILLINOIS

PHYSICAL INDETERMINACY AND PHILOSOPHICAL DETERMINISM

HEISENBERG has shown that if we use quantum-mechanical definitions of material particles and their interactions we admit a certain indeterminacy in experimental findings. It follows that, on this basis, it is impossible to prove or disprove the hypothesis that the physical universe is causally connected. It is the purpose of this note to point out that, nevertheless, the "principle of indeterminacy" does not change the status of philosophical determinism for the worse, as some suppose, but rather for the better.

The impossibility of proving strict causality by experiment was, in fact, just as apparent without resort to quantum-mechanical arguments. No careful physicist ever supposed that experiment could be so perfectly controlled as to furnish infinite precision. This meant that experiment could never specify one state of a system so completely that another state (earlier or later) could be calculated precisely, even if the laws of physics were themselves immutable. Otherwise put, no two states could be recorded so completely as to rule out the possibility that non-causal processes had occurred between them. Heisenberg's result merely makes it clear that the spread between calculation and observation may be wide when the systems treated contain individually observable particles. We may conclude that the postulation of a determinate (causal) universe is even farther from the possibility of physical upset than it was a few years ago.

The philosophical implications of Heisenberg's principle would probably not have been misinterpreted if no attempt had been made to build a deterministic philosophy on experimental data alone, without conscious abstractions. Such an attempt is interesting, and any degree of success in it is admirable. We do not, however, expect a philosophy so handicapped to be of the very first quality, any more than we expect one-armed golfers to win national championships, or caves, however neat, to replace more commodious dwellings. The chief defect of such hand-to-mouth empiricism seems to be that it must build upon inconsistent experimental data and has no criterion within itself for resolving such contradictions as thereby arise. Whether or not it uses quantum-mechanical concepts it is foredoomed to chaos. Another difficulty arises in respect to the observer and his observing equipment. Since it seems impossible to write down abbreviations for these in the simple way in which the numerical results of measurement appear in the attempted synthesis, there is a strong tendency to leave them out of the philosophic scheme altogether. Incidentally, this probably precludes such a philosophy from arriving at any ethics whatever. Perhaps its evasion from everything but meter sticks, springs and clocks explains its popularity among experiment addicts.

L. W. MCKEEHAN

SLOANE PHYSICS LABORATORY
YALE UNIVERSITY

IS THE KILLARNEY GRANITE DIFFERENT IN AGE FROM THE ALGOMAN?

IN a recent address[1] entitled "Certain Aspects of Geologic Classifications and Correlations" Professor Rollin T. Chamberlin makes two statements in his discussion of pre-Cambrian correlations, which interest me as a rather sweeping expression of a theory which is important if true, but which is contradicted by some easily observable facts. He says: "For a given province, such as the southern margin of the Canadian Shield, or at least important portions of it, the granite method of classifying rock systems is theoretically sound. In this particular province the three granites of widely different ages, the Laurentian, Algoman and Killarney, are practically and potentially of great assistance in unravelling and delimiting the pre-Cambrian systems." Again: "From geologic evidence, the Laurentian, Algoman and Killarney granites appear to be so different in age that radioactive age determinations should distinguish between them."

The important matter in these statements is the recognition without question or doubt of the Killarney granite as distinct from the Algoman. The proponents of this view regard the Killarney granite as of Keweenawan or post-Keweenawan age. Counter to this belief are the facts that a herd of olivine diabase dykes, presumably Keweenawan in age, cut the Killarney granite, and that north of Sault Ste. Marie the lavas of the Keweenawan were poured out on the deeply eroded surface of the Killarney granite. In view of these facts, set forth in my paper on "Some Huronian Problems,"[2] it is somewhat surprising to see in textbooks and authoritative reviews like Chamberlin's dogmatic statements of the distinction between the Killarney and Algoman granite. In so far as I have been able to discover in the field and in the literature of the subject the Killarney granite is the Algoman granite; and it would be of interest if the "geologic evidence" as to their difference in age to which Professor Chamberlin refers might be set forth so that, if necessary, it might be checked up in the field.

ANDREW C. LAWSON

UNIVERSITY OF CALIFORNIA

GINKGO

RECENT news reports of monoecious growth in a century-old Ginkgo near Philadelphia can not be trusted direct. Could such a phenomenon result from injury instead of earlier unknown grafting? Possibly the most extraordinary anomaly in Ginkgo is a growth of microsporangia directly on the foliage leaves, "usually near their bases." This appears to be a true recessiveness, recalling an older seed fern condition, precedent even to the Cordaites. But evidence bearing on the morphologic as well as physiologic nature of sex in the seed plants is much wanted, and discussion must long fall short of final analysis. We must long search and search through the rocks and the forests before the origin of the conifers and their relationship to the Cordaites and flowering cycads can be better discerned.

In a few weeks (early May) the Ginkgo tree will blossom. For any fruit of a seed plant—dicot, monocot or gymnosperm—begins as a "blossom" or in an absolute sense a "flower." Though not alone in common usage but by definition a "flowering plant" means a higher seed plant which has advanced far toward a relative specialization of stem and foliar structure and which may bear round its fertile organs an inclosing husk of large and beautiful vari-colored cataphylls, soon wilting away or sometimes fusing into the mature fruit. Essentially, however, the flower is an axial prolongation beyond the series of modified protecting foliar organs consisting in a subtending cyclic or spirally set series of microsporophylls or stamens, as followed by a terminal megasporophyll or series of such, but with the seeds always inclosed—the angiospermous condition. Since, however, these seeds are inclosed within the megasporophylls which may bear many seeds or but one, and may be single or numerous and either cyclic or spirally set, flowers so readily assume an infinite variety of form, size and color. The much modified foliar structures characteristically bear the nectaries haunted by insect and bird. Where flowers are *unisexual* the implication is that they were once *bisexual*—in fairly recent geologic time, "complete," "perfect," *hermaphrodite*. While in the foliar fusion about the ovule and fruit there is seen a late reflex of the far simpler course of growth and fusion which at least as far back as Devonian times resulted in the large seeds of Pteridosperms and Cordaites, often with heavy bundle-supplied integuments. In this sense there is a fundamental analogy between seed and flower.

Nevertheless, by some strange ratiocination the simpler forms of sex-perfect flowers seem to have been long regarded by geologists as being little older than Cretaceous time. And this deception long found its way into botany, despite the presence of the vestigial flowers of Gnetaleans, and obvious reasons for the failure of a fossil floral record in the Permian and older Mesozoic rocks. Could the evidence in view be taken so superficially, accepted so directly? As apposed to the ordinary or higher types of flowers, the "cones" of the conifers differ mainly in a uniform unisexuality, with much fusion of parts and a high

[1] SCIENCE, February 22 and March 1, 1935.
[2] *Bull.* G. S. A., Vol. 40, pp. 361–384, 1929.

degree of sclerotization and persistence, easily leading to fossilization. Hence not alone the fossil record, but cone structures and old types must be far more closely scanned before it is assumed that cones are older than flowers. Where then may sporophyll fusion and sex variation of an instructive form be first expected? Certainly in Ginkgo, perhaps even more primitive than the cycads, although the reverse view has been commonly held. Both are in fact very primitive, considering the lengthening out of geologic time; but we see neither until after the organization of unisexual cones, and the cycads are much out of the easy observation range.

Ginkgo, if not even recessive, is but little in advance of the Cordaites, and like them bears long-stalked seeds tending to run into bunches of three to five with much fusion, the normal number being two. These bunches appear sparsely grouped on the somewhat persistent short or spur shoots. They are hence seen in an open or sub-inflorescent stage. The same is true of the staminate cones. The conditions appear simpler than in conifers, and one of the first questions any one who has the opportunity to see Ginkgo in free fruiting may seek to answer is whether abnormal bisexual axes of any kind may ever occur as in conifers. For while botanists have seemed even to prescribe the possibility of varied types of ancient flowers, a trend of change from separate to united sexes has not once been proven in all the range of seed plants. Uniformly late separation of the sexes affords the first explanation of dioecism and usually also of monoecism. Though what actually constitutes separateness of sex in a tree as compared with an animal is very little seen or understood.

G. R. WIELAND

CARNEGIE INSTITUTION

SCIENTIFIC BOOKS

THE ICE AGE

The Changing World of the Ice Age. By REGINALD A. DALY. Yale University Press. Large octavo. 271 + xxii pages, 149 figures. $5.00.

DARWIN, Dana, Davis, Daly—delvers in the deep and doughty disputants! In this book the century-old problem of the genesis of coral reefs has its latest serious discussion; but not its last.

The debated subject is an excellent example of changing theory with increase of knowledge. When Charles Darwin brought the romantic topic of coral islands to public attention glacial science was yet unborn. And when, toward half a century later, James D. Dana revived scientific interest by his charming work on "Corals and Coral Islands" the fact that sea levels had been effectively changed, up and down, by the waxing and waning of the Pleistocene ice-sheets was not clearly recognized. But now pelagic science is involved with glaciology, and the latter closely with geophysics.

Darwin believed that the relation of coral growth and the building of barrier reefs and atolls implied submergence. Deepening of the ocean basins with subsidence of the reef-bearing floors was the simple and fully satisfactory explanation. This was accepted and emphasized by Dana and recently amplified by Davis. But they were in error in attributing the vertical oceanic-surface movement entirely, or even largely, to diastrophic movements of the earth's crust. The important factor in the shifting of sea level in later or Pleistocene time was the transfer of water between sea and land by the production and the destruction of the continental ice-sheets.

The "Glacial Control" theory has for more than twenty years been championed by Professor Daly. A student of glaciology and geophysics, he has traveled widely, studied the coral reefs at first hand, and with his active imagination and boldness in presentation of new views he has, by numerous writings, become the apostle of the later theory. A word of exposition is desirable.

The mass or volume of the two great existing ice caps, Antarctica and Greenland, is fairly estimated. The melting of those ice fields and the return of the water to the sea would lift the ocean surface by about 164 feet. During the recent Ice Age or Pleistocene vast areas of Europe and North America were deeply covered by solid water abstracted from the sea, and sufficient in volume to lower the ocean surface about 345 feet, in careful estimate. Taking into the account the involved diastrophic factor, the deformation of the globe by shifting of loads, Daly estimates an actual lowering of relative sea level of 90 meters or 295 feet. The final melting of the ice caps, a few tens of thousands of years ago, returned the borrowed water to the sea and lifted the ocean surface to practically its present position.

Whatever were the changes in glaciation and deglaciation of the lands during the Ice Age it is now apparent that the volume of the ocean was correspondingly altered. For clearer presentation of his theory the author groups the four generally recognized glacial stages into two major periods, with a long intermediate stage of deglaciation (interglacial) with

its warmer climate and higher ocean level. And he assigns the initiation of the present coral reefs to the phase of low sea level during the second, or latest, major period of glaciation, and their construction during the waning of the ice caps and in post-glacial time, while the sea level was rising. The reefs built during the long deglaciation interval were destroyed during the low-water stage of the subsequent glacial period. The history so conceived is graphically given in his figure 130. Abundant illustrations, 135 diagrams and maps and 14 photographs, supplement the author's descriptions and enforce his views.

This writing will provoke lively discussion and some friendly disagreement, especially relating to the age of the reefs and the origin and date of the level platforms from which rise most of the wall-like reefs. And the degree of diastrophic effect in comparison with the glacial control may also be subject of debate. But that the chief cause of changes in ocean level in later geologic time was the removal and the restoration of water by glacial processes appears to be well established. The author's "punching hypothesis" in explanation of the crustal downthrow and the recoil, instead of crustal flexure, will receive the attention of the geophysicists.

The arrangement of matter in the volume and the style of presentation are related to the origin of the work, a series of Silliman Lectures at Yale University. The matter relating to coral reefs is the closing part of the volume. The larger part of the handsome and richly illustrated volume is the description of the Pleistocene ice fields of Europe and America, and their diastrophic effects in elastic and plastic-flow distortion of the globe; all this leading to the coral reef problem.

European glaciology is well covered, and the references make a considerable bibliography of European glacial literature. American glaciology is treated briefly and with reliance on older writings and official and "authoritative" publications that are outdated. Later and individual writings are overlooked or neglected. Some omissions and errors in statement and maps are noted.

Admittedly the writing leaves a thousand questions unanswered. And with the author's fertility in hypothesizing it suggests many more than it settles. The great persistent interrogation in glacial science, the cause of Pleistocene glaciation, and especially of multiple ice stages, is untouched.

The work is a stimulating contribution to earth science. Pressing boldly into the area of the theoretic and speculative is more helpful to scientific progress than conservative standstill in acceptance of supposed fact and deference to authority.

HERMAN L. FAIRCHILD
UNIVERSITY OF ROCHESTER

VARIETIES OF HYDROGEN

Orthohydrogen, Parahydrogen, and Heavy Hydrogen. By ADALBERT FARKAS. 215 pages. Cambridge University Press. 1935. Price, $3.50.

FOR the past few years the author of the present text has taken an active part in those rapid research developments which have transformed our knowledge of the element hydrogen. Prior to the discovery of the heavy isotope, deuterium, the ordinary isotope of mass 1 had been shown, by theoretical reasoning and the brilliant experiments of Bonhoeffer, Harteck and Eucken, to exist in two molecular forms, ortho- and para-, determined by nuclear spin. In the study of the chemical and physical properties of these molecules the author and his brother, L. Farkas, were able collaborators of Bonhoeffer. They studied, principally, kinetic properties of the two forms and the important rôle which paramagnetic substances may play in the interconversion of the molecules. It was not surprising, therefore, that they rapidly reoriented their work when the complexity of the element was still further increased by the discovery of deuterium, employing their already acquired technique to the rapid solution of new problems which obviously arose.

Dr. A. Farkas has placed all workers in the field under a debt of obligation to him by this monograph. He has wisely chosen to outline both ortho- and parahydrogen and heavy hydrogen because of the interdependence of the two fields. The book contains an excellent summary of the physical chemistry of both hydrogen isotopes, equally effectively presented on the theoretical, practical, historical and bibliographical sides. It is especially welcome to harassed workers in this feverishly active research field bringing into one volume, without exception so far as the reviewer can find, all the important contributions in the two spheres of work, up to the end of last year. No one can read this book without realizing how a major discovery of this kind has consequences of importance over a wide area of scientific interest. Fundamental problems concerning energy states of molecules, nuclear structure and properties, spectra, reaction kinetics, isotope equilibria, properties of solutions, mechanism in chemical and biological processes, all these have developed under the stimulus of the discoveries concerning the element hydrogen. All are presented in this book in outline, in an orderly presentation, excellently readable in spite of the fact that the author is writing in, to him, a foreign language. The book is indispensable to a wide variety of research men and to graduate students in physics and physical chemistry. It is the best approach that those scientists unfamiliar with the field can take to this new and fascinating development of the last six years.

HUGH S. TAYLOR
PRINCETON UNIVERSITY

STATE ACADEMIES

THE VIRGINIA ACADEMY OF SCIENCE

THE Virginia Academy of Science held its thirteenth annual meeting at the University of Richmond on May 2 and 3, 1935, with a registration of 503.

The address at the open meeting Friday night was delivered by Alexander Wetmore, director of the U. S. National Museum, and 168 papers were read before the various sections.

The annual prize of fifty dollars was awarded to Margaret Hess for a paper entitled "Edema and General Atrophy in *Stenostomum oesophagium* Associated with Atrophy of the Protonephridium." Honorable mention was also accorded two other papers, one by Herbert Trotter, Jr., on the "Acceleration of Electrons to High Energies" and the other by Robert E. Lutz and Fred S. Palmer on "The Structures of the Dimolecular Reduction Products of Dibenzoylethylene."

The research committee reported that grants in aid of research had been made during the year to J. W. Beams, W. B. Bell, Walter S. Flory, H. B. Haag, C. C. Speidel and Edward Steidtmann.

The officers elected for the coming year are as follows: Ida Sitler, of Hollins College, becomes president, having been president-elect for the past year; H. E. Jordan, of the University of Virginia, president-elect; E. C. L. Miller, secretary-treasurer; W. H. Keeble, of Randolph-Macon College, councilor.

The following officers of sections were elected:

Astronomy, Mathematics and Physics: Mary J. Cox, *chairman;* R. C. Weaver, *secretary.*

Biology: Harry G. Walker, *chairman;* Robert F. Smart, *subchairman;* George W. Chappelear, Jr., *secretary.*

Education: J. L. Manahan, *chairman;* William L. Prince, *secretary.*

Chemistry: R. E. Hussey, *chairman;* Roy S. Cook, *secretary.*

Geology: Arthur Bevan, *chairman;* William M. McGill, *secretary.*

Medical Sciences: L. E. Starr, *chairman;* H. B. Haag, *secretary.*

Psychology: John M. McGinnis, *chairman;* R. C. Sommerville, *secretary.*

At the close of the meeting the members of the geology section made a field trip to the topaz deposits in Amelia County, and the members of the biology section made a field trip to the Dismal Swamp.

E. C. L. MILLER,
Secretary

THE KANSAS ACADEMY OF SCIENCE

THE sixty-seventh annual meeting of the Kansas Academy of Science was held at Lawrence, Kansas, from March 28 to 30. Professor Wm. H. Matthews, associate professor of physics, Kansas State Teachers College, Pittsburg, Kansas, presided, and Dr. F. C. Gates, professor of botany, Kansas State College, served as secretary *pro-tem,* following the death of Dr. George E. Johnson. Two hundred and eighty persons registered for the meetings. There were 138 papers listed on the general and sectional programs, and four high schools gave demonstrations for the Junior Academy meeting, of which Dr. Hazel Branch, of the University of Wichita, has general charge.

Sectional meetings were held for botany, zoology, medical science, chemistry, physics, psychology, entomology and the Junior Academy of Science. Special tribute was paid to the late Dr. Geo. E. Johnson, who served admirably as secretary since 1928, for his untiring efforts in behalf of the academy.

The following addresses were special features of the meeting: "Glimpses of Germany," by Dr. Ralph H. Major, Kansas University; the presidential address by President Matthews on "Scientific Development and Investigation in Southeast Kansas," and "Tree Rings and Climate in Relation to Civilizations of the Southwest," by Dr. A. E. Douglass, University of Arizona.

The new officers elected are: W. J. Baumgartner, *president;* L. Oncley, *first vice-president;* H. H. Hall, *second vice-president;* Roger C. Smith, *secretary;* H. A. Zinszer, *treasurer,* and F. C. Gates, *editor-in-chief* of the *Transactions* of the Kansas Academy of Science, whose term of office is three years. W. J. Baumgartner was elected managing editor, and four associate editors were chosen. They are C. A. Kelly, E. O. Deere, W. W. Floyd and Robert Taft.

Chairmen of sections for 1935–1936 are: L. E. Melchers, botany; C. H. Whitnah, chemistry; Kathleen Doering, entomology; H. A. Zinszer, physics; Bert Nash, psychology; James E. Ackert, zoology; Hazel Branch, Junior Academy.

The next annual meeting of the academy will be at the Kansas State Teachers College, Emporia, Kansas, in the spring of 1936.

ROGER C. SMITH,
Secretary

THE ARKANSAS ACADEMY OF SCIENCES, ARTS AND LETTERS

THE nineteenth annual meeting of the Arkansas Academy of Sciences, Arts and Letters was held at Henderson State Teachers College on Friday and Saturday, April 19 and 20. A very satisfactory representation of the membership was in attendance.

On Friday evening, Professor H. L. Minton, of the Arkansas State Teachers College of Conway, delivered an illustrated public address on "The Tornado in the United States." On Saturday morning, a field trip was led by the state geologist, Dr. George C. Branner, to the Magnet Cove region.

Officers elected for the ensuing year are as follows:

President, Dr. Hugh H. Hyman, Henderson State Teachers College.

Vice-president, Professor W. C. Munn, Magnolia A. and M. College.

Secretary, Dr. Lewis M. Turner, University of Arkansas.

Treasurer, Dr. William R. Horsfall, Monticello A. and M. College.

Editor, Professor M. Dennison, Henderson State Teachers College.

The meeting next year will be at Monticello A. and M. College at Monticello.

LEWIS M. TURNER,
Secretary

THE SOUTH DAKOTA ACADEMY OF SCIENCE

THE twentieth annual meeting of the South Dakota Academy of Science was held at Dakota Wesleyan University, Mitchell, South Dakota. The attendance was unusually good. Twenty-nine papers were read by members. The guest speaker was Dr. J. Howard Mathews, director of the course in chemistry at the University of Wisconsin, who spoke on the subject, "The Use of Scientific Methods in the Detection of the Criminal."

The following officers were elected for the year 1935–36:

President, Wm. H. Powers, South Dakota State College.

First Vice-president, Gregg M. Evans, Yankton College.

Second Vice-president, Charles A. Hunter, University of South Dakota.

Secretary-treasurer, A. L. Haines, University of South Dakota.

A. L. HAINES,
Secretary-Treasurer

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW MATERIAL FOR CORROSION PREPARATIONS

CORROSION preparations have yielded a great deal to our knowledge of the vascular system and to our knowledge of hollow organs. The general technique and the limitations of the method are fairly well defined through many years of use. To state the procedures briefly, a vessel or cavity is first filled with a solidifying mass and then the soft tissues, or both the soft tissue and bone, surrounding the mass, are removed.

A wide variety of solidifying masses have been used; waxy or fatty masses, alloys of low fusion point and masses prepared from guncotton. These guncotton masses have found considerable favor because, in contrast to the metallic or wax masses, they may be injected cold. Further, they are commonly less fragile than the wax masses and more complete than the metallic injections. Originally introduced, at least into the literature, by Schiefferdecker[1] with the use of celloidin, the materials have been widely altered. One common method, especially about hospital laboratories, is to make use of discarded x-ray films as a base for preparing the mass. In 1929, at the meeting of the American Association of Anatomists at Rochester, I demonstrated the use of the then recently introduced brush pyroxylin lacquers in the preparation of corrosions.[2] The arteries of the white rat were used for demonstration. Such fine details as the glomeruli of the kidney were beautifully shown. The use of these commercial lacquers had the advantage that the pigments were already provided. The disadvantage was that the solvent was not completely miscible with water, and as a result the mass would set slowly. Recently these lacquers are no longer readily available, except through the automobile paint trade. Various modifications have been tried, such as allowing these commercial lacquers to solidify in air and then suspending the solids in acetone. The results are satisfactory, but the method is troublesome.

The disadvantage of pyroxylin masses had always been due to the low percentage of concentration that it was possible to use. This resulted in great shrinkage, particularly noticeable in the larger blood vessels. The working rule of those who have pursued the corrosion method has always been to use wax or metal for studying larger structures and pyroxylin masses for studying the finer ramifications.

This difficulty of shrinkage has been in part overcome, and a very satisfactory and easily working mass has been simply obtained by using one of the guncottons devised for the lacquer industry. Use has already been made of low viscosity guncotton for microscopic technique.[3] The feature of this material is that a solution containing approximately 50 per cent. solids can

[1] Schiefferdecker, *Arch. Anat. Phys.*, 1882; *Anat. Abt.*, p. 201.

[2] *Anat. Rec.*, 42: 1, March, 1929.

[3] Saul Ruby, *Anat. Rec.*, 55: sup. 74, 1933.

be injected with a hand syringe. The particular material used is "dehydrated nitrocellulose, RS ½ second, viscosity 3.2," obtainable from Hercules Powder Company of Wilmington, Delaware. The lower viscosity product, designated as "RS 18–23 cps.," has also been used, but the resulting preparations are too brittle for practical use. The mass is made up as follows:

nitrocellulose (Hercules RS ½ second)	1,000 grams
acetone (technical grade)	1,000 cc

Solution is accomplished in about twelve hours. The mass may be colored with artists' oil pigments, which are conveniently put into the mass by working up with a small quantity of dioxan.[4] English vermillion is particularly suitable as a color. Acetone soluble stains are much easier to use. Of the microscopic stains commonly available, toluidin blue gives a fairly satisfactory mass and fat soluble brilliant red gives a usable red. These may be dissolved in the acetone before the mass is made or may be added in small quantity of solution subsequently.

Maceration is accomplished as usual, either in concentrated technical hydrochloric acid or by this acid slightly diluted—one part water to five parts acid. If it is desired to retain the bone, maceration in water at body temperature is carried out.

The nitrocellulose as furnished contains 30 per cent. alcohol. With the repeated opening and closing of the container, some of the alcohol is lost; therefore, less quantity of the solid can be used. Moreover, the mass above given represents the maximum viscosity which it has been found practical to inject. Dilution should be practiced as required.

With this material corrosions of the entire vascular system of the adult head have been made, both with and without the destruction of the bone.[5] The material is sufficiently solid so that the corrosions may be handled dry with little fear of breakage. However, they are being mounted in distilled water containing a small amount of formaldehyde.

The costs of the materials used are at this time as follows:

nitrocellulose—10 lb. quantities		$4.08
acetone, technical—5 gal. lots (30 lbs.)	@	.20½ lb.
hydrochloric acid, technical—per carboy (115 lbs.)	@	.05½ lb.

It requires about three days to macerate an adult head. However, sometimes a fourth day with fresh acid is necessary. Small specimens macerate over night.

OSCAR V. BATSON

GRADUATE SCHOOL OF MEDICINE
UNIVERSITY OF PENNSYLVANIA

[4] H. W. Mossman, *Anat. Rec.*, 58: 4, supplement, March, 1934.

[5] A series of specimens so prepared was demonstrated at the College of Physicians, Philadelphia, Pa., January 16, 1935.

SPECIAL ARTICLES

ABSORPTION OF NITRATES BY CORN IN THE DARK

THE effect of light and dark on plants is outside the writer's field of work; but some years ago he blundered into the experiment described below after a discussion with H. A. Allard concerning the "length of day" effect on plants. The question arose whether plants normally absorb ions in the dark. Curiosity on this point was not satisfied by texts on plant physiology; hence an experiment was performed with corn, using nitrate as the ion whose absorption was to be measured. Several previous investigations show that a small amount of nitrate may be absorbed in the dark by plants kept continuously in the dark, but these studies do not show what takes place in plants growing naturally. In the following experiment the plants were grown under the normal condition of an alternation of light and darkness.

Corn plants were grown in nutrient solutions with 7 hours of light and 17 hours of darkness each day. Solutions were renewed or changed twice daily, at the beginning and end of the light period. There were two check lots that received uniform treatment in both light and dark; one was supplied with a complete nutrient solution in both periods and the other with a solution lacking only nitrate. A third lot received the nitrogen-free solution in the light and the complete solution in the dark, while the fourth lot received the complete solution in the light and the nitrogen-free in the dark. The plants were grown in this way for 12 days and then analyzed. Seedlings used in installing the experiment were previously grown for 7 days in a nitrogen-free solution to produce a nitrogen deficiency. Plants receiving nitrate at any period made a good growth and were normal in appearance. Data on growth and nitrogen assimilation are given in Table 1. The experiment is doubtless entitled to more confidence than indicated by the probable errors of the average weights, since, when the experiment was installed, the seedlings were selected for uniformity by fours, one for each treatment; as a result, the 12 seedlings receiving the same treatment were quite variable in size.

The data show quite plainly that corn grown under alternating periods of light and dark is capable of assimilating nitrate fully as well in darkness as in

TABLE 1

CORN GROWN WITH NITRATE SUPPLIED IN THE LIGHT AND IN THE DARK

When nitrate supplied	Average oven-dry weight per two plants		Ratio of roots / tops	Nitrogen in dry substance of		Nitrogen in two plants	Relative quantities nitrogen absorbed
	tops	roots		tops	roots		
	gm	gm		Per cent.	Per cent.	gm	gm
None at any time	.34 ± .02	.20	.59	1.64	1.19	.0079	0
Both in light and in dark	.62 ± .02	.19	.31	4.49	3.74	.0348	100
In dark only	.63 ± .04	.23	.36	4.21	3.01	.0335	95
In light only	.61 ± .03	.22	.36	3.57	2.68	.0275	73

* Each lot consisted of 6 similarly treated flasks containing two plants each. Data reported are for the average flask of two plants.

light. Further, the root-to-top ratios indicate that the nitrogen requirement was satisfied almost as well by part-time as by continuous exposure to nitrate, for it has been observed that an unfavorable condition for absorbing an essential ion usually produces an increase in the root-to-top ratio.[1] The somewhat smaller quantity of nitrogen assimilated by plants receiving nitrate only in the light, as compared with the quantity taken up by plants receiving nitrate only in the dark, may be due to the comparatively short duration of the light period, 7 hours as compared with the 17 hours of darkness.

Since the plant appears able to take up practically all the nitrogen it needs in complete darkness, it seems that investigations dealing with the influence of light of different intensities and wave-lengths on nitrate absorption are more or less beside the point.[2] Evidently, the effect of light on ion absorption is indirect, the direct effect of light being on carbohydrate synthesis or on changes in organic matter which in turn control ion absorption. This is indicated by experiments of other investigators who found that seedlings and cuttings maintained continuously in the dark absorbed nitrate only in proportion to their carbohydrate or sugar reserves.[3,4,5] Hoagland's[6] experiments with *Nitella*, which took up bromine only in the light, are not necessarily contradictory, since his experimental conditions did not preclude the possibility that bromine absorption was dependent on changes in organic matter that take place only in the light.

That the absorption of an ion may take place in the dark, lagging behind processes which take place in the light, is in harmony with the delayed absorption of ions that necessarily takes place when plants are grown in "fractionated" solutions; that is, grown alternately in different incomplete solutions. Gericke[7] has claimed that plants may grow even better when alternated between a complete solution and a phosphorus-free than when grown continuously in a complete solution.

Whether plants grown under ordinary field conditions usually take up nitrate chiefly in the light or in the dark can be answered certainly only by further experiments. But if the preceding explanation is correct—that nitrate absorption is dependent on synthesis or changes in carbohydrates in the light—it seems that most of the nitrate would be taken up in the light. A lesser part, however, would be taken up in the dark, since the last quantity of organic matter changed in the light would presumably exert a "pull" on nitrates in the dark. The optimum condition for growth would obviously be when nitrates are available both in the light and dark, as shown in the above experiment.

P. L. GILE

BUREAU OF CHEMISTRY AND SOILS
U. S. DEPARTMENT OF AGRICULTURE

PERMO-CARBONIFEROUS COAL SERIES RELATED TO SOUTHERN HEMISPHERE GLACIATION

DURING the early Carboniferous (Early Mississippian) there were broad clear inland seas in various parts of the world in which thick masses of limestone accumulated. On top of these limestones is found a series of rocks extending up into the Permian which are of a very different character. These consist of numerous alternations between coarse terrestrial sediments, such as sandstone, arkose and conglomerate, and marine sediments, such as shale and limestone. Such alternations have been called sedimentary cycles. Be-

[1] P. L. Gile and J. O. Carrero, *Jour. Agr. Res.*, 31: 545–573, 1921.
[2] W. E. Tottingham, *Plant Physiol.*, 9: 127–142, 1934.
[3] N. Suzuki, *Bull. Coll. Agri. Tokyo*, III: 488–508, 1897–98.
[4] M. E. Reid, *Am. Jour. Bot.*, 13: 548–574, 1926.
[5] M. E. Reid, *Bot. Gaz.*, 87: 81–118, 1929.
[6] D. R. Hoagland and A. R. Davis, *Jour. Gen. Physiol.*, 8: 47–62, 1924.
[7] W. F. Gericke, SCIENCE, 40: 297–298, 1924.

tween the coarse clastic formations and the fine sea deposits are found most of the great coal formations which supply the markets of the world with this type of fuel.

It happens that there is abundant evidence of the existence of huge glaciers in the southern hemisphere during the very times when these curious alternations of deposits were being formed.[1] A relation between these continental glaciers and the sedimentary cycles has been proposed recently by the writers.[2] It is well known that the growth of these various great glaciers of the Pleistocene ice age was accompanied by raising and lowering of the sea level hundreds of feet and by world-wide climatic alternations. Many geologists believe the Permo-Carboniferous glaciers were more extensive than those of the recent ice age, and certainly the glacial conditions persisted over a much greater span of time than the recent ice age. They were probably accompanied by the same waxing and waning of the ice masses. The resulting changes of sea level and of world climate may have caused the alternating types of sediment which go to make up the coal series.

To see how these conditions would have operated, let us start with the formation of the first great glaciers. As the glaciers grew, more and more water would have been withdrawn from the shallow seas which were previously spread over much of the continental surfaces. As the seas withdrew the climate would have grown colder as an accompaniment of the advancing glacial conditions, and greater aridity may have resulted from the decrease of evaporating surfaces from which the atmosphere derived its moisture. The net result would have been the killing of vegetation on the slopes of the mountainous lands which were supplying the inland basins with sediment. Since most semi-arid regions now have periodic heavy rains, it is likely that these barren mountain slopes would have been subjected to violent storms with accelerated erosion, and coarse debris would have been spread as great fans over the emergent lowlands. At this time and in subsequent glacial epochs the coarse continental sediments of the cycles would have accumulated.

With the warming of the climate which led to the melting of the glaciers and the rise in sea level, the slopes would have again become cloaked with vegetation and the streams would have ceased contributing the coarse sediment which had been due to rapid slope wash. As the ground water was raised on the plains and profuse vegetation began to grow, swampy conditions would have developed and in these swamps the peat which later formed coal could have accumulate The upward growth of the great tangles of vegetatio may have held back the advancing seas till large acc mulations had been formed in many places.

When the rising seas finally overwhelmed th swamps the marine phases of the cycle set in and a accumulation of muddy sediments formed a cover ov the peat beds causing the peat to turn gradually int coal. After the sea level had risen sufficiently t drown the lower courses of the land valleys the mu which had been washed into the open seas would b deposited in the resulting bays and the seas would hav cleared and allowed the deposition of limestone. Re turn of the glacial climates would have led to a repet tion of the cycle and of the special sequence of forma tions already described.

The explanation which has been outlined does no attempt to account for all the phenomena observe in connection with these sedimentary formation The sequence of formations has been generalized an is actually more complex due to varying local condi tions, to the distance of different areas from th sources of sediment, and perhaps to the oscillator character of the advancing and retreating seas. Th explanation has been proposed as a substitute to th hypothesis that the cycles were due to alternate up lift and sinking of the basins of sedimentation and o a much greater, but contemporaneous, uplift an sinking of the source areas. There are mechanica difficulties in such an explanation, especially in vie of the wide-spread recognition of the cyclic phenom ena during these periods. On the other hand, eart movements probably had an important effect on th sedimentation, but it seems likely that these move ments were largely of the order of slow progressiv sinking of the basins in which the sediments wer accumulating and slow rising of the mountainou tracts which were the source areas of the sediment.

Francis P. Shepard
Harold R. Wanless

University of Illinois

[1] A. L. Du Toit, Abst. XVI, International Geol. Cong., p. 27.

[2] Harold R. Wanless and Francis P. Shepard, "Sea Level and Climatic Changes Related to Late Paleozoic Cycles of Sedimentation." Presented before the Geological Society of America, December 29, 1934.

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